# STUDIES ON THE PISCIAN TAPE WORMS WITH SPECIAL REFERENCE TO CERTAIN PARAMETER OF ECOHAEMATOLOGY OF CHANNA PUNCTATUS (BLOCH)

Thesis Submitted to the
Bundelkhand University, Jhansi
for the Degree of
**Doctor of Philosophy**
in
Zoology


By

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# CERTIFICATE

This is hereby certified that the thesis entitled "**Studies on the piscian tape worms with special reference to certain parameter of ecohaematology of *Channa punctatus* (Bloch)**" embodies the original research work of Shweta Lohia.

The candidate had worked under my guidance and supervision for the period required ordinance 7.

The candidate has put the required attendance in the department during the reasearch period.

Dated : 17.5.2000

(**A. K. SRIVASTAV**)

# PART - A

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**Shweta Lohia**

# INTRODUCTION

A number of fresh water fishes constitute highly nutritive food for human beings. Some of them are considered as delicacies. These edible fishes are known to harbour a number of cestode, nematode, trematode and acanthocephala parasites which cause deterioration in their health, hence their nutritive and market value is effected. The curiosity of the author to know about the helminth parasites found in such fishes lead her to undertake the present project. In the present thesis the author has restricted herself to the nature of infection of cestode parasites only. With a view to know the nature and extent of cestode infection, regular studies were under taken to record the nature of parasitism in fresh water fish *Channa punctatus* (Bloch) for two successive years. To have the idea of the state of infection in some fresh water fishes the survey was conducted in different parts of district Jhansi.

The present thesis deals with some of the interesting cestodes obtained during the survey which include the description of three new genera, six new species with a new family.

The new species *Lytocestoides nandenpurensis* n.sp. belong to the family Lytocestoidae Hunter, 1927 of the order Caryophyllidea Beneden in Carus, 1863. So far only fifteen genera have been reported from the family Lytocestoidae Hunter, 1927 from the whole world. Out of them eight genera have been reported from the oriental region having six from Indian subcontinent. The present new species *Lytocestoides nandanpurensis* n. sp. have been reported from the genus *Lytocestoides* Baylis, 1928.

The new genus *Pseudobilobulata* n.g. represnet the family Capingentidae Hunter, 1930 of the order Caryophyllidea Beneden in Carus, 1863. So far only nine genera have been reported from the family Capingentidae from the whole world. Out of them five genera have been reported from the oriental region and Indian subcontinent. The present new genus is the sixth from Indian subcontinent.

The new species *Cephalochlamys orchhaensis* n. sp. belong to the family Cephalochlamydidae Yamaguti, 1959 of the order Pseudophyllidea Carus, 1863. So far only one species have been reproted from the genus *Cephalochlamys* Blanchard, 1908 from the whole world. Present species *Cephalochlamys orchhaensis* n. sp. first report from India.

The new species *Philobythos prasadi* n. sp. belong to the family Philobythiidae, Campbell 1977 of the order Pseudophyllidea Carus, 1868. So far only one species have been reproted from the genus *Philobythos* Campbell,1977 from the whole world. Present species *Philobythos prasadi* n. sp. first report from India and second in world.

The new genus *Sukhobythos capoori* n.g., n.sp. Campbell, 1977 of the order Pseudophyllidea Carus, 1868. So for only two genera have been reported from the family Philobythidae Campbell, 1977 from the whole world. Both genera have been reported from the marine teleosts from north and northwest Atlantic region. The present new genus is the third from Indian subcontinent and first from fresh water fishes.

The new family Jalpiidae n.f. comes closer to philobythiidae Campbell, 1977 order Caryophyllidea Beneden in carus, 1868. *Jalpos* n.g. first report of n.f. Jalpiidae.

With a view to discover the cestode host relationships exmination of the fresh water fish, *Channa punctatus* (Bloch) has been performed for two successive years. The prevalence, mean intensity and relative density of cestode infection has been worked out in relation to the body weight, sex of the host and cloacal temperature of the host.

Life evolved first in the water. The primitive unicellular animals took its oxygen and nutrition from water and excreted its waste products into it. But with the development of the multicellular forms, this simple arrangement of drainage and supply could no longer hold. The cells in the deeper parts of the body could not come into free contact with surrounding water and would therefore suffer. To over come this difficulty a system of inter-communicating channels developed pervading the whole animal body and opening upon the exterior. Through these channels the water could freely flow in and out and in this way the deeper cells could

satisty their needs. This channel system represents the primitive circulatory system.

In the course of evolution that enclosed water has undergone profound modifications and has been transformed into what we call now blood. Although blood has departed a long way form its prmitive ancester yet in its inorganic composition it still maintains a close resemblance with water.

Blood may be described as a specialised connective tissue in which liquid portion named as plasma. The corpuscles (red blood cells and white blood cell) and the platelets are suspended in the plasma. These cells are continually being distroyed either because as a result of their functional activities and replaced by newly formed cells.

The study of fish blood have their own importance as Hickey (1976) has given more and more stress on regular haematological observations of fishes for their proper maintenance and production, since these form a very valuable source of high energy and protein rich food particularly when more than 50% of humun population all over the globe is suffering severly from mal-nutrition. Hence fish health should be a matter of great importance to all human being specially to the fish biologiate.

During the course of study some fishes harbouring cestode parasites were found. This provide an excellent oppertunity to study physiopathological changes.

# HISTORICAL

Several workers have contributd to the knowledge of cestode taxonomy from the Indian subcontinent.

Southwell's contribution has been classical. Apart from his classical volume of "Fauna of British India" his pioneering cotributions include the descriptions of many new species. In 1913 Southwell reviewed the cestode material then existing in the Indian museum collection. They included *Gangesia bengalensis* (1913), *Gigantoline magna*(1915) from fresh water fishes.

The important collection of Woodland comprise *Amphilina paragonopora* (1923), *Lytocestus fillformes* (1923), *Wenyonia virilis* (1923), *Wenyonia acuminata* (1923), *Wenyonia minuta* (1923), *Gangesia macrons* (1923), *Caryophyllaeus chalmarsius* (1924), *Gangesia wallago* (1924), *Senga pycnomere* (1924), *Marsipocephalus heterobranchus* (1925) , *Nomimoscolex piraeeba* (1934) , *Nomimoscolex kaparari* (1935) , *Nomimoscolex lenha* (1935) , *Nomimoscolex piractinga* (1935) , *Nomimoscolex sudobim* (1935) , *Endorchis mandube* (1935), *Protoeocephalus kuyukuyu* (1935) , *Stocksia punjehuni* (1937) *Stocksia lezera* (1937) *and Proteocephalus bivitellatus* (1937)

The important contribution of Dollfus comprise *Senga besnardi* (1934) *Senga ophiocephalina* (1934) and *Senga pycnomera* (1934).

Gupta S.P. described many known and unknown cestodes from U.P. His important contribution are *Lucknowia follilisi* (1961) , *Capingentoides batrachii* (1961) , *Pseudolytocestus clariae* (1961) , *Preudocaryophllaeus indica* (1961) and *Capingentoides heteropneusti* (1980 with Sinha).

Shinde G.B. described a number of known and unknown cestodes. His important contributions are *Circumoncobothrium ophiocephali* (1968), *Lytocestoides aurangabadensis* and *Circumoncobothrium raoii(1976* with Jadhav), *Uncibilocularis southweli*(1976with

Chincholkar), *Circumomcobothrium khamii* (1977), *Circumoncobothrium shindei* (1977 with Chincholkar), *Scyphophyllidium arabianisis* (1977 with Chincholkar).

The investigations of Zaidi and Khan ranged over Pakistan. His important contributions comprise *Bovienia ilishai* (1976) , *Hornelliella palasoorahi* (1976), *Senga taunsaensis* (1976), *Thysanocephalum karachii* (1976), *Pithophorus pakistanensis* (1976) and *Vermaia sorrakowahi* (1976).

Besides the major contributions of the aforesaid workers a number of stray papers have been published by Mathur (1992) and Mathur and Srivastav , A.K. (1996).

Very scanty work has been done on the ecology on the cestode parasites, Mathur (1992) has tried to make relation of cestode parasites with the *Heteropneustes fossilis* (Bloch.) of Bundelkhand region of Uttar Pradesh.

The effect of length and weight on the Total Erythrocyte Count (TEC) have been noted by Dombrowsky (1953), Preston (1960) , Ostrumova (1960 a, b) and Joshi and Tandon (1977 a).

It has been noted that the Total Erythrocyte Count (TEC) values also fluctuate during different seasons. Syrov (1970), Joshi and Tandon (1977 b) and Khan (1977) have reported higher Total Erythrocyte Count (TEC) values during summer months. A general fall in Total Erythrocyte Count (TEC) value is reported.

Total Leucocytes Count (TLC) have been made on a large variety of fish fauna as described by Malassez (1872) , Hall *et al* (1926) , Reznikoff and Reznikoff (1934), Albritton (1952), Mott (1957), Lyask (1959), Preston (1960), Hawe and Goodnight (1962) , Puchkov (1964). Andrew (1965), Mcknight (1966), Srivastava (1968 b) , Blaxhall (1972), Hickey (1976), Tandon and Joshi (1976), Joshi and Tandon (1977 b) and Pandey and Pandey (1977).

Besides various other factors influence of Total Leucocytes Count (TLC) values in fishes, such as varying length and weight (Joshi and Tandon 1977 a ), Temperature (Slicher, 1961; Einszpron Orecka ,1970; Farghaly *et al* 1973 and Pandey, 1977) Season (Plessis,

1958; Murachi 1959 and Khan 1977)and Parasites (Tandon and Joshi ,1973; Pandey and Pandey,1974 and Ikeda *et al* 1976) have been reported.

Haemoglobin (Hb) contents of the fish blood under normal and different ecophysiological conditions have been pooled out by many workers Hall,*et al* (1926) ; Hall and Gray (1929) ; Reznikoff and Reznikoff (1934) ; Fieid *et al* (1943); Higginbotham and Meyer (1948); Kisch (1949 a); Scholander and Vandan (1957);Ostrumova (1960a,b);Preston(1960);Pradhan (1961) ;Hawe and Goodnight (1967); Mulcahy (1970); Dey and Upadhyaya (1972) ; Rao and Behura (1973) ; Bagchi and Ibrahim (1974) ; Pandey and Pandey (1977); and Prasad *et al* (1977).

Concentration of haemoglobin in most of the teleosts is said to be higher than the elasmobranch fishes (Hall and Gray,1929). Active fishes with higher rate of body metabolism are reported to contain more haemoglobin in their blood than the sluggish forms Hall and Gray (1929) , Root (1931) ,Shubnikov (1959) ,Hawe and Goodnight (1962), Kiawe *et al* (1963) and Cameron (1970), Influence of age, length, weight, sex and temperature on the haemoglobin concentration of fish blood have also been reported by several workers Lysaya (1951), Ostrumova (1960 a, b), Molner *et al* (1967), Pradhan (1961) ,Hocachaka (1961), Banerjee (1966),Kuzmian (1966),Radzinskaya (1967), De wilde and Houston (1967), Mulcahy (1976), Joshi and Tandon (1977) and Pandey (1977) Seasonal changes have also been found in Haemoglobin (Hb) contents, Schayer (1925), Preston (1960), Radzinskaya (1966) , Griggs (1968) , Smisnova (1970), Syrov (1970), Foda (1974) , and Joshi and Tandon (1977) have worked on the seasonal variation in Haemoglobin contents of fishes.

Studies on the Packed Cell Volume (PCV) or the haematocrit values of the fishes are scant Fieid *et al* (1943), Young (1949), Prosser and Weinstein (1950), Albritton (1952), Thorson (1958, 1959, and 1961), Preston (1960), Pradhan (1961), Hawe and Goodnight (1962), Steucke and Atherton (1965), Grigge (1968) Chlebeck and Phillips (1969), Mulcahy (1970), Weinreb *et al* (1972), Shorburne (1973 a),Prasad *et at* (1977) and Pandey and Pandey (1977) as compared with Total Erythrocyte Count,Total Leucocyte Count and Haemoglobin content.

Observbation on the Erthrocyte Sedimentation Rate (ESR) have been made by Schumacher *et al* (1956), Murachi (1959), Preston (1960), Sano (1960), Sinderman and Meirs (1961), Barnheart (1969), Blaxhall (1972) and Pandey and Pandey (1977). Thus comparatively less attention has been paid to this part of fish haematology.

The studies regarding the absolute values of the blood are most same, Mean Corpuscular Haemoglobin (MCH) value of fishes has been reported mainly by Weinreb *et al* (1972),Ikeda *et al* (1970) and Prasad *et al* (1977).

The studies made on the Mean Corpuscular Haemoglobin Concentration (MCHC) are mainly those reported by De Wilde and Houston (1967), Weinreb *et al* (1972), Fange and Sjobeck (1975), Boivio *et al* (1974 b and 1975) and Prasad *et al* (1977).

# MATERIAL AND METHODS

The alimentary canal of the host was removed and cut open in normal saline water in troughs or petridishes. It was lightly shaken and the contents decanted several times. The intestine and its contents containing parasites were examined thoroughly under a binocular microscope to ensure that none of the parasite is left behind. In some cases as the scolices were deeply embedded it was found necessary to take them out by scraping the mucosa of the intestine with a sharp scalpel or by releasing the scolices with a pair of needles. Later portion of the mucosa attached to the cestode in the normal saline water. The worms were stretched in luke warm water and in case of larger worms by lifting them by the help of needles or forceps against the edges of petridishes repeatedly for several times and later on fixed in 5% formalin or alcoholic Bouin's fluid. Fixed and washed worms were stored in 5% formalin till needed for study.

The whole mounts were stained in either Borax carmine or Mayer's Haemalum. The Mayer's Haemalum proved to be the best stain for cestodes. Whole mounts were either cleared in xylol or clove oil. For sectioning the material was cleared in xylol embedded in histowax and cut at 0.006 - 0.008 mm stained with Delafield's Haematoxyline and Eosin and mounted in canada balsam. The worms have also been studied in living condition.

Only camera lucida drawings were made. All the measurements have been given in millimeters unless other wise stated. Averages taken on the basis of the study of three to ten worms except in cases where still fewer worms were obtained.

During the course of study the total number of hosts thus examined was 168. The hosts examined belong to 8 species of fishes.

For the study of cestodes host relationship *Channa punctatus* (Bloch) was selected.The live fishes were obtained through local fish catchers. A thorough study of five fishes were made in every month. This was continued for two successive years. Following process was used in the study of cesstode host relationship.

(a) Live fishes were weighted individually.

(b) Sexes were identified .

(c) The alimentary canal of the fish was cut open in the normal saline solution in a petridish.

(d) The four kinds of parasites viz. cestodes, nematodes, trematodes and acantnocephala were collected and counted separately in each infection.

(e) The morphological studies of the cestodes, thus obtained were performed and their diagnosis completed on the basis of the study of permanent stained slides.

A total number of 110 *Channa punctatus* (Bloch) were examined and 62 of them were found infected for helminth infection. The total number of 209 helminth parasites were obtained which included 17 cestodes, 26 trematodes and 116 acanthocephala.

During the ecological studies prevalence, mean intensity and relative density were calculated. The definitions given by Morgolis etal 1982 were followed.

**1. Prevalence** - Number of individuals of a host species infected with a particular parasite species divided by number of hosts examined.

$$\text{Prevalence} = \frac{\text{Number of host infected}}{\text{Number of host examined}}$$

**2. Mean Intensity** - Total number of host individuals of a particular parasite species in a sample of a host species divided by number of infected individuals of the host species in the sample.

$$\text{Mean Intensity} = \frac{\text{Total number of cestodes obtained}}{\text{Total number of hosts infected.}}$$

**3. Relative Density** - Total number of individuals of a particular parasite species in a sample of host divided by total number of individuals of the host species.

$$\text{Relative Density} = \frac{\text{Total number of cestodes obtained}}{\text{Total number of hosts examined}}$$

Prevalence, Mean intensity and Relative density of cestode parasites were calculated, annual, season wise and month wise in relation to the following parameters :-

(a) Body weight of the host.

(b) Sex of the host.

(c) Cloacal Temperature of the host.

The fish *Channa punctatus* was selected to make normal and experimental studies on various haematological parameters. The fishes were caught with the help of local fishermen and animal catcher of department. These fishes were kept in the aquarium. For taking blood each fish was taken out of aquarium with the help of small butterfly net and immediately made unconecious either by stunning it with a sharp blow on the head or decapitation by severing the spinal cord. The caudal part of the fish is cut down and the blood is taken out from the vein and stored in clean vial with the help of Double oxalate as anticoagulent.

A thin blood film was made by spreading a drop of blood evenly across a clean grease free slide using a smooth edged spreader. Blood slides were stained in Leishman's stain or Wright's stain and were mounted in D.P.X.

The Red Blood Corpuscles (RBC) and White Blood Corpuscles (WBC) counts were recorded with the help of haemocytometer which includes two graduated pipette in which dilution is done. One pipette with a red bead is used for counting RBC while the other with a white bead for counting WBC. Besides those pipette the haemocytometer includes a glass slide ie Neubauar's Counting Chamber. It bears two counting chambers with a coverslip. Take the pipette meant for RBC which is already rinsed with alcohol or spirit or other and thoroughly dried. Take care that air bubbles would not be included. The pipette should now be transfered to the container of hayem's solution which is carefully sucked upto 101 mark

and blood is throughly mixed with hayem's fluid. Before starting to count RBC in this diluted blood, place the coverslip on the counting chambers. The coverslip is supported upon the slide plateform but remains separated from the central plateforms by a distance of 0.1 mm First reject 3 or 4 drops of the mixture from the pipette. Now apply the tip of the pipette between the coverslip and the platform and allow few drops of blood mixture to flow in the narrow space between the coverslip and the counting chambers. If necessary both chambers may be filled in this manners. Blood mixture remains filled up between the coverslip and counting chambers because of capillary action. Air should not be taken into and also pouring excess blood mixture so that the H-shaped groove remains free from it. When the counting chambers are properly flooded the slide may kept aside for a few minutes so that the RBC settele down on the bottom floor of the two counting chambers. Now transfer the slide gentely and carefully under the microscope without disturbing the setteled RBC and start counting them.

The procedure of counting WBC is the same as that of the RBC. The WBC were counted in the four corners of one square mm in the central ruled area on both the slides of the counting chambers of the haemocytometer. The WBC were recognised by the refractile appearence and by the slight colour given to them by the stain contained in the diluting fluid. The cells touching the boundary lines were not counted.

The method to estimate the flood based on the principle of making an acid haematin solution of blood under experimentation in the graduated tube and comparing it with the sealed comparison tube containing the standered acid haematin.

The graduated tube cleaned with distilled water and then with methylated spirit or 90% alcohal was thoroughly dried before being used. Now with the help of dropper the N/10 HCl solution was filled in the graduatted tube and filled by sucking fresh blood of *Channa punctatus* up to the mark of 20 cm. The blood of micropipette was added to the N/10HCI solution in the graduated tube. The pipette should be introduced carefully into the tube and its lower mouth should pass right upto the bottom into HCl solution. When blood had been expelled the pipette was rinsed twice or thrice by distilled water. Every time the contents of micropipette

should be expelled into the graduated tube. The Acid haematin solution was thoroughly stirred with the help of a glass rod and then allowed to stand at least for 10 minutes. Acid haematin solution was gradually diluted by adding distilled water drop by drop with the addition of each drop of distilled water. The solution should be stirred and its colour match with that of the standered sealed tubes. This should be continued till colour of the acid haematin solution just fades away as compared to that of the standered comparison tubes .The reading before the colour just fades away as compared to that of the standered comparison tube. The reading before the colour just fade was taken as the correct and final reading. In addition in conjuction with accurate estimation of Haemoglobin (Hb) and Red Blood Corpuscles (RBC) count.Packed cell volume(PCV) was observed in centrifuge at 3,000 rpm using Wintrobe tubes.Erythrocyte Sedimentation Rate (ESR) was observed by Westegren tube method. Knowledge of the PCV enables the calculation of "absolute" values.

The Mean corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC) have been reffered to as "absolute" values. These values calculated from the results of the red cell count, haemoglobin estimation and packed cell volume.

**1.The Mean Corpuscular Volume (MCV)** which represent the average volume of the red cells . It is calculated from the red cell count and packed cell volume (PCV) .The packed cell volume as a percentage is divided by the red cell count in millions per cubic milimeter and multipliedby 10 . the answer is expressed in cubic micro (cμ).

$$MCV = \frac{PCV \times 10}{TEC}$$

**2.The Mean Corpuscular Haemoglobin (MCH)** represents the average weight of haemoglobin contained in each cell. The influenced by the size of the cell and the concentration of the haemoglobin in the cell . It is calculated from the haemoglobin and red cell count. The haemoglobin in grams per 100 ml is divided by the red cell count in millions per cubic milimeter and multiplied by 10.The answer is expressed in micro micro grams (μμg).

$$MCH = \frac{Hb \times 10}{TEC}$$

**3. The Mean Corpuscular Haemoglobin Concentration (MCHC)** represents the average concentration of haemoglobin in the red cells. It is calculated from the haemoglobin and packed cell volume .The haemoglobin in grams per 100 ml being devided by the packed cell volume , the result being multiplied by 100 and expressed as percentage.

$$MCHC = \frac{Hb \times 100}{PCV}$$

# HOST PARASITE LIST

| Hosts | Number examined | Number Infeted with cestode | Cestodes obtained |
|---|---|---|---|
| *Channa marulius* | 5 | - | - |
| *Channa punctatus* | 110 | 4 | *Cephalochlamys orchhaensis* n. sp. |
| *Clarius batrachus* | 15 | 5 | *Lytocestoides nandanpurensis* n. sp. |
| | | | *Pseudobilobulata batrachus* n.g., n.sp. |
| *Heteropneustes fossilis* | 3 | - | - |
| *Labeo rohita* | 10 | - | - |
| *Mastacembelus armatus* | 12 | 7 | *Jalpos pahujenesis* n.g., n.sp. |
| | | | *Sukhobythos capoori* n.g. , n.sp. |
| *Mystus tengra* | 10 | 7 | *Philobythos prasadi* n.sp. |
| *Notopterus notopterus* | 3 | - | - |

# CLASSIFIED LIST OF CESTODE PARASITES DESCRIBED IN THE THESIS

| | | |
|---|---|---|
| Class | - | Cestoda |
| Subclass | - | Eucestoda Southwell,1930 |
| Order | - | Caryophyllidea Beneden in Carus,1863 |
| Family | - | Lytocestoidae Hunter,1927 |
| Genus | - | *Lytocestoides* Baylis,1928 |
| Species | - | *Lytocestoides nandanpurensis* n.sp. |
| Family | - | Capingentidae Hunter,1930 |
| Genus | - | *Pseudobilobulata* n.g. |
| Species | - | *Pseudobilobulata batrachus* n.g. ,n. sp. |
| Order | - | Pseudophyllidea Carus ,1868 |
| Family | - | Cephalochlaydidae Yamaguti,1959 |
| Genus | - | *Cephalochlamys* Blanchard,1908 |
| Species | - | *Cephalochlamys orchhaensis* n.sp. |
| Family | - | Philobythiidae Campbell,1977 |
| Genus | - | *Philobythos* Campbell,1977 |
| Sepcies | - | *Philobythos prasadi* n.sp. |
| Genus | - | *Sukhobythos* n.g. |
| Species | - | *Sukhobythos capoori* n.g. ,n.sp. |
| Family | - | Jalpiidae n.f. |
| Genus | - | *Jalpos* n.g. |
| Species | - | *Jalpos pahujensis* n.g. ,n.sp. |

# PART - B

**Order -** **Caryophyllidea Beneden in Carus, 1863**

**Family-** **Lytocestoidae Hunter, 1927**

**Genus -** ***Lytocestoides* Baylis, 1928**

**Species-** ***Lytocestoides nandanpurensis* n. sp.**

(Plate 1, Figs. 1-2)

One, Out of six fishes *Clarius batrachus* (Linn.) were caught at Pahuj Dam, district Jhansi which yielded three cestodes in its intestine.Morphological studies of the cestode belong to the genus *Lytocestoides* Baylis,1928 of the family Lytocestidae Hunter,1927 order Caryophyllidea Beneden in carus, 1863.

Cestodes measure 0.63-0.84X0.192 -0.228 (0.66X0.21). Scolex conical measure 0.070-0.085X0.05-0.07(0.075X0.06) without any groove.

Testes numerous, oval to round, measures 0.005-0.015 (0.010) in diameter scattered arround the cirrus pouch in medullary parenchyma. Cirrus pouch oval, median measures 0.012-0.018 (0.015) in dimeter. Internal and external seminal vesicles absent.

Female genitalia posteriorly located. Ovary band shaped, measures 0.012-0.018X0.09-0.12 (0.09X0.12),behind the uterus. Vitelline follicles laterally located measure 0.006-0.012(0.008) even behind the ovary. Uterus nonglandular, coiled, situated posteriorly.

Genital pores median.Male and female genital pores open separately.

# Discussion

The present form comes closer to *Lytocestoides aurangabadensis* Shinde, 1970.From *Lytocestoides aurangabadensis* Shinde,1970 it differs in having longer scolex without longitudinal grooves, transversly bilobed ovary and lateraly located vitelline follicles.

| | | |
|---|---|---|
| Host | - | *Clarius batrachus* (Linn.) |
| Habitat | - | Intestine |
| Locality | - | Pahuj Dam, Jhansi |
| Holotype | - | P.G. Department of Zoology |
| | | Bipin Bihari College, Jhansi |

**Comparison of the characters of *Lytocestoides aurangabadensis* Shinde, 1970 to *Lytocestoides nandanpurensis* n. sp.**

| | *L. aurangabadensis* Shinde, 1970 | *L. nandapuesnsis* n.sp. |
|---|---|---|
| Scloex | Short, conical with longitudinal grooves. | Long conical without longitudinal grooves. |
| Ovary | Indistinctly bilobed medullary. | Transversly bilobed. |
| Vitelline follicles | Extensive postovarian | Laterally located and dense. |

## EXPLANATION OF PLATE - 1

PLATE-1 *Lytocestoides nandanpurensis* n. sp.
Fig.-1 Scolex with neck (5x10)
Fig.-2 Posterior region of the body (5x10)

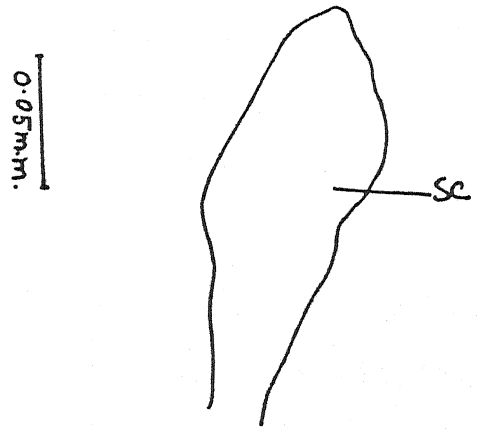



Fig-1

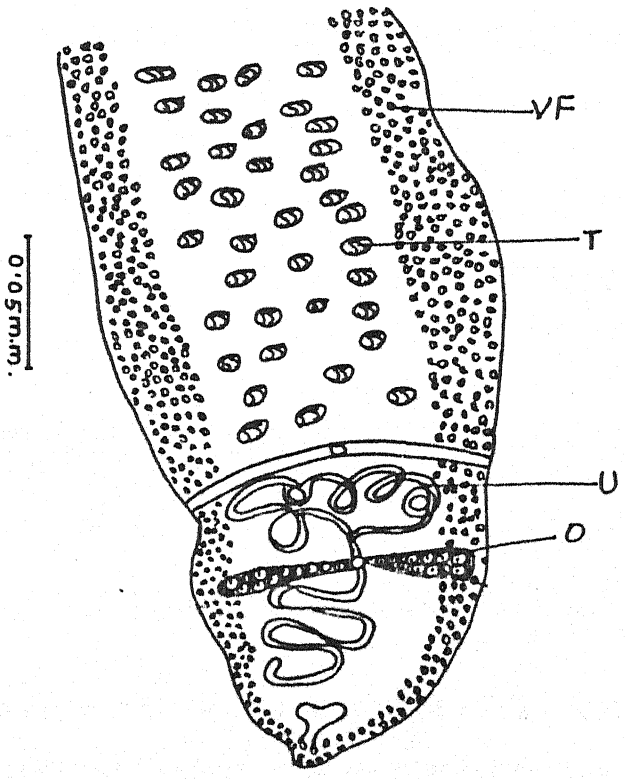



Fig-2

# PLATE - 1

**Order - Caryophyllidea Beneden in Carus, 1863**

**Family - Capingentidae Hunter, 1930**

**Genus - *Pseudobilobulata* n.g.**

**Species - *Pseudobilobulata batrachus* n.g. , n.sp.**

**(Plate 2, Figs. 1- 3)**

Four out of six fishes, *Claricus batrachus* (Linn.) were caught at Pahuj Dam , district Jhansi which yielded twenty cestodes in their intestines. Morphological studies of the cestodes revealed them to belong to a new genus *Pseudobilobulata* n.g. and a new species *Pseudobilobulata batrachus* n.g, n.sp. of the family Capingentidae Hunter, 1930 and order Caryophyllidea Beneden in Carus, 1863.

## GENERIC DIAGNOSIS

Medium sized worm with smooth and blunt scolex, without any cushion or groove or spines. Distinctly demarcated neck, testes numerous and ovary bilobed. Cirrus pouch well developed. Bilobed ovary posteriorly located.Post ovarian follicles absent.Uterus extends posterior to ovary.

## *Pseudobilobulata batrachus* n.g., n. sp.

Cestodes measures 1.32-1.62(1.47) in length and 0.39-0.0.48 (0.43) in width.Scolex smooth and without any cushion. Scolex measure o.29-0.48X0.09-0.15 ( 0.39X0.12).

Testes numerous , oval to round , measures 0.006-0.018 (0.012),located anterior to cirrus pouch. Cirrus pouch round median, measures 0.048-0.072 (0.06) in diameter. Internal and external seminal vesicles absent.

Female genitalia posteriorly located. Ovary bilobed measures 0.20-0.36(0.30) behind the cirrus pouch. Lateral lobes situated in cortex and in medullary region. Vitellaria cortical, innumerable, exteding even beyond the anterior and posterior to the testicular zone. Vitellaria measures 0.001-0.012X0.001-0.012(0.005X0.005).Receptaculum seminis absent.Uterus nongladular, coiled, medullary, situated posterior and anterior to ovarian isthmus. Eggs oval measurs 0.012-0.018 (0.0135) in diameter.

# Discussion

So for a genera in family capingentidae Hunter ,1930 have been described. The present form comes closer to the genus *Pseudocaryophyllaeus* Gupta ,1961.

The present form differs from *pseudocaryophyllaeus* Gupta,1961 in having smaller neek, bilobed ovary and extension of vitelline follicles.

Thus the proposed new genus *Pseudobilobulata* n.g. differs from all the known genera of the family capingentidae Hunter,1930.

In the light of above discussion the species *Pseudobilobulata batrachus* n.g., n. sp. may be provisionally accommodated in the proposed new genus *Pseudobilobulata* n.g.

| | | |
|---|---|---|
| Host | - | *Clarius batrachus* (Linn.) |
| Habital | - | Intestine |
| Locality | - | Jhansi |
| Holotype | - | P.G. Department of Zoology. |
| | | Bipin Bihari College, Jhansi. |

## Key to the various genera of the family -

## Capingentidae Hunter,1930

1. Postovarian median vitellaria present .....2

   Postovarian median vitellaria absent.....6

2. Uterine coils extends anterior to cirrus pouch, scolex with two large bothria.....

   .....Capingens Hunter, 1927

   Uterine coils not extending anteriro to cirus pouch, scolex lacking bothria.....

   .....3

3. Ovary like inverted A-shaped .....*Adenoscolex* Fotedar, 1958

   Ovary not as above.....4

4. Ovary dumbell shaped, scolex quite reduced, neek absent.....

   .....*Breviscolex* Kulakowskaya,1962

   Ovary otherwise, scolex well developed, neck present .....5

5. Ovary H-shaped.....*Edlintonia* Mackiewiez, 1970

   Ovary band shaped.....*Capingentoides* Gupta, 1961

6. Ovary U shaped, uterine coils not extending anterior to cirrus pouch.....

   .....*Spartoides* Hunter , 1929

   Overy not U Shaped ,Uterine coils not extending anterior to cirrus pouch.....7

7. Neck absent, ovary. H - shaped.....*Pseudolytocestus* Hunter, 1929

   Very long neek present, ovary band shaped .....

   .....*Pseudocaryophyllaeus* Gupta,1961

   Neck small, ovary bilobed ..... *Pseudobilobulata* n.g.

## EXPLANATION OF PLATE-2

PLATE-2

Fig.-1 *Pseudobilobulata batrachus* n.g., n.sp.
Scolex with neck (5x10)

Fig.-2 Middle region of the body (5x10)

Fig.-3 Posterior region of the body (5x10)

## EXPLANATION OF PLATE-2

| | |
|---|---|
| PLATE-2 | *Pseudobilobulata batrachus* n.g., n.sp. |
| Fig.-1 | Scolex with neck (5x10) |
| Fig.-2 | Middle region of the body (5x10) |
| Fig.-3 | Posterior region of the body (5x10) |

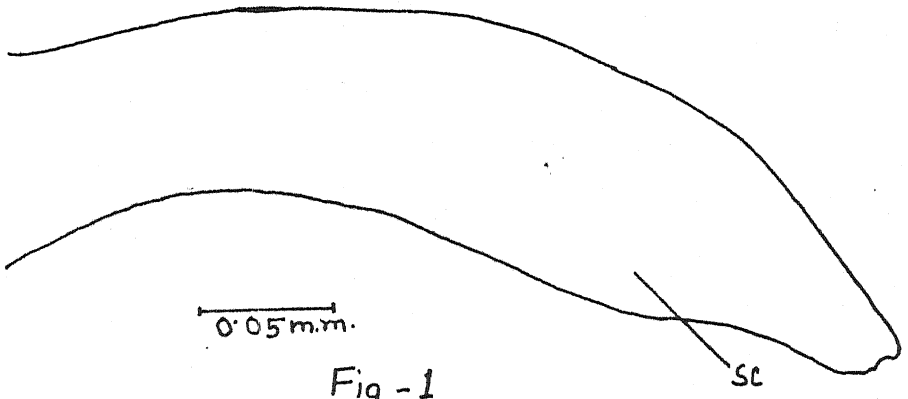



Fig - 1

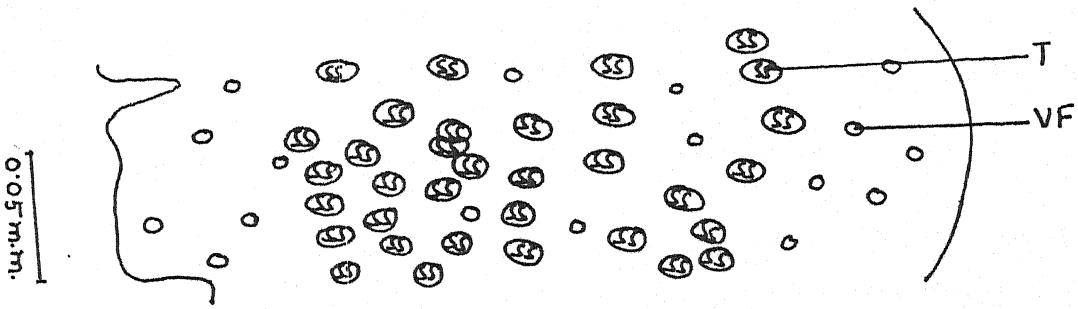



Fig - 2

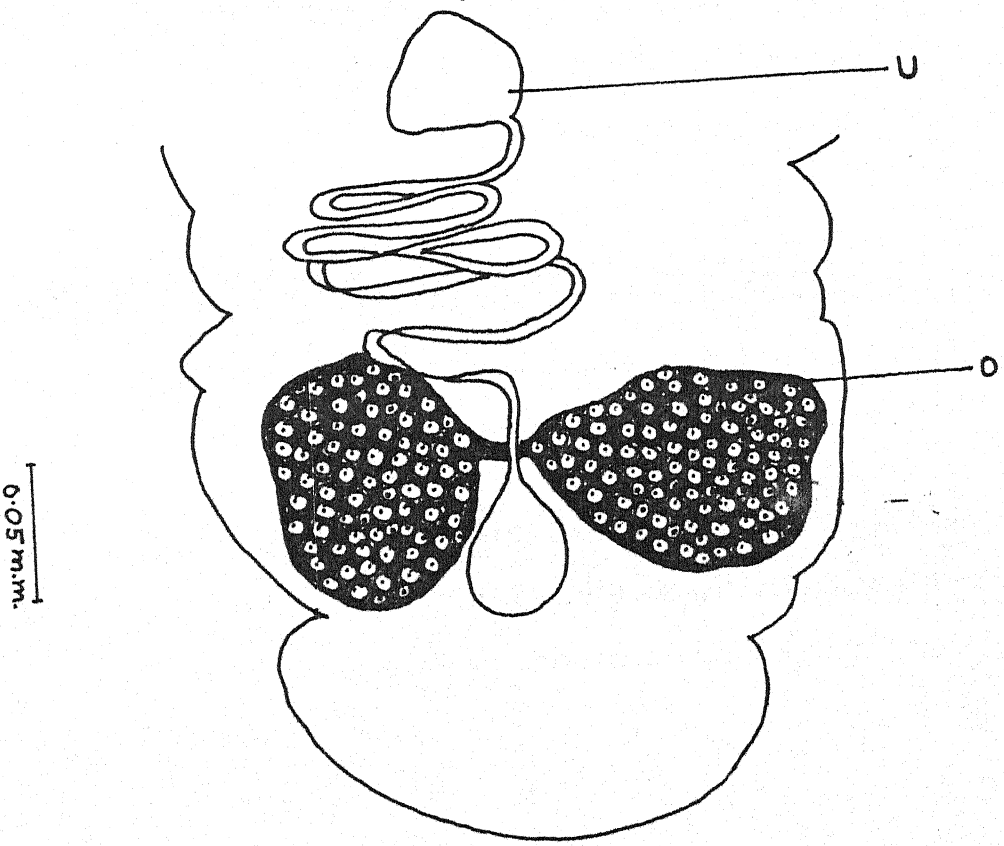



Fig - 3

# PLATE - 2

**Order -** **Pseudophyllidea Carus, 1863**

**Family -** **Cephalochlamydidae Yamaguti, 1959**

**Genus -** ***Cephalochlamys* Blanchard, 1908**

**Species-** ***Cephalochlamys orchhaensis* n.sp.**

**(Plate 3 Figs. 1-3)**

Out of four *channa punctatus* (Bloch) examined in Jhansi, One was found infected with two cestodes in its intestine. Morphological studies of the cestode revealed them to belong to genus *Cephalochlamys* and a new species *Cephalochlamys orchhaensis* n. sp. of the family Cephalochlamydidae Yamaguti, 1959 order Pseudophyllidea Carus,1863.

Large sized cestode. Scolex conical in shape measures 0.08-0.15X0.068-0.192 (0.128X0.12). Apical organ present measures 0.012-0.035 (0.026). Bothridia measures 0.07-0.15X0.03-0.06 (0.132X0.04). Neck measures 0.07 - 0.108 (0.096) in length . Proglottids wider than long. Immature proglottids measure 0.114-0.15X0.018-0.036. Mature proglottids measure 0.13-0.21X0.032-0.06 (0.15-0.048). Gravid proglottids measure 0.16-0.24X0.06-0.078 (0.228X0.06).

Testes oval to round ,30-45 in number,measures 0.001-0.011(0.005) in diameter, scattered throughout the proglottid which never cross the ventral longitudinal excretory canals and a few testes below ovary. Cirrus pouch absent.Internal and external seminal vesicles absent.

. Female genitalia posteriorly situated. Ovary bilobed medullary, measure 0.006-0.018X0.055-0.011(0.008X0.08). Vitelline follicles dense and in two lateral bands in cortical region measure 0.003-0.012 (0.005)in diameter.Uterus tube like measures. 0.018-0.032X0.006-0.015 (0.021X0.012).

# Discussion

The present form comes closer to genus *Cephalochlamys* Blanchard (1908), The present form differs from *Cephalochlamys namaquensis* (Cohn, 1906) Blanchard ,1908 in having conical shaped bothria , wider than long proglottids , larger number of testes in single field and bilobed ovary.

| | | |
|---|---|---|
| Host | - | *Channa punctatus* (Bloch) |
| Habitat | - | Intestine |
| Locality | - | Jhansi |
| Holotype | - | P.G. Departement of Zoology |
| | | Bipin Bihari College, Jhansi |

**Comparison of the Characters of *Cephalochlamys namaquensis* (Cohn, 1906) Blanchard , 1908 to *Cephalochlamys orchhaensis* n. sp.**

| | *Cephalochlamys namaquensis* (Cohn 1906) Blanchard, 1908 | *Cephalochlamys orchhaensis* n.sp. |
|---|---|---|
| Scolex | Flat, bothria present. | Conical shaped, bothria present |
| Proglottids | Longer than wide | wider than long. |
| Testes | Seven to twelve on each side in two groups. | In single group joined by few testes posteriorly |
| Ovary | Dumbell shaped, anterior and posterior lobes strongly developed. | bilobed, medullary. |
| Vitellaria | Lateral to osmoregulatory canals, not extending to post ovarian area. | In two lateral bands in cortical region. |

## EXPLANATION OF PLATE - 3

PLATE-3 *Cephalochlamys orchhaensis* n.sp.
Fig.-1 Scolex with neck (5x10)
Fig.-2 Mature Proglottids (5x10)
Fig.-3 Gravid Proglottids (5x10)

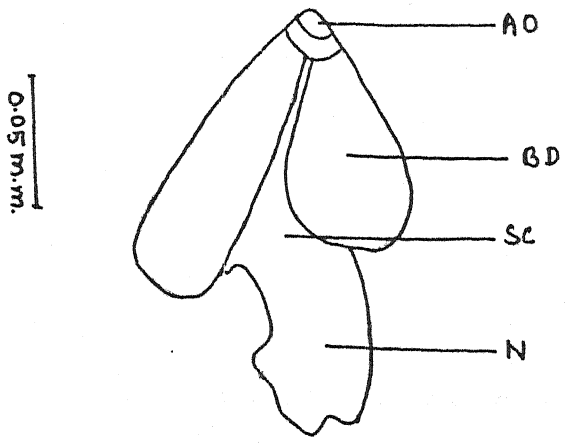



Fig - 1

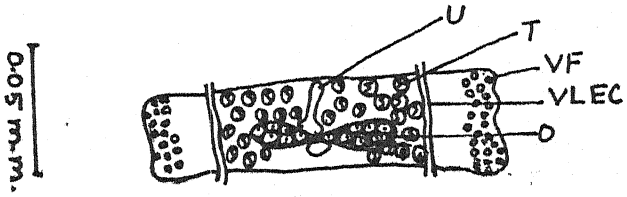



Fig - 2

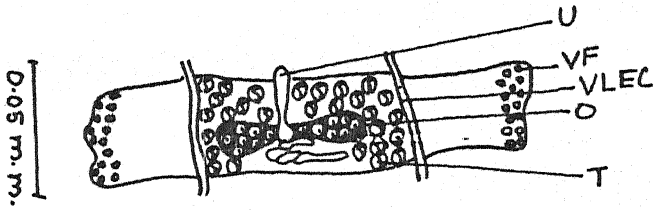



Fig - 3

# PLATE - 3

| | | |
|---|---|---|
| **Order** | - | **Pseudophyllidea Carus 1863.** |
| **Family** | - | **Philobythiidae Campbell, 1977** |
| **Genus** | - | ***Philobythos* Campbell, 1977** |
| **Species** | - | ***Philobythos prasadi n.sp.*** |

**(Plate 4, figs. 1-5)**

Two out of seven *Mystus tengra* yielded five cestodes in its intestine. Morphological studies of cestodes revealed them to belong to genus *Philobythos* Campbell, 1977 of the family Philobythiidae Campbell, 1977 and order Pseudophyllidea Carus, 1863.

Scolex well developed, lingulate narrow anteriorly and broad posteriorly measures 0.185-0.216 X 0.086-0.175 (0.192 X 0.126). Bothria sac like measures 0.12-0.18X0.03-0.08 (0.15X0.06). Rostellar hooks 32-34 in number arranged is single row. Rostellar hooks measure 0.035-0.045 (0.04). Neck well developed measure 0.007-0.18 (0.12) in length.

Broader than long proglottids, numerous in number. Immature proglottids measure 0.047-0.053X0.154-0.272 (0.048X0.187), Mature proglottids and gravid proglottides measure 0.030-0.133X0.144-0.186 (0.062X0.16).

Testes oval to round numerous in number scattered through out the proglottids and cross the ventral longitudinal excretory canal . Testes scattered through out the proglottids measures 0.002-0.018 (0.015 in diameter). Cirrus pouch small, oval measures 0.014-0.03 in length.

Ovary centrally located ,dumbell shaped bilobed each lobe is further lobulated with a long isthmus. Ovary measures 0.06-0.12 (0.08) in diameter. Vitellariam postovarian measures 0.014-0.030 (0.021) in diameter.

Uterus sac like, preovarian located in the middle of the proglottids and measures 0.002-0.15X0.032-0.15 (0.032X0.11) genital opening at the center of ovary.

# Discussion

The present form comes closer to genus *Philobythos* Campbell, 1977 .The present form differs from *Philobythos atlanticus* Campbell ,1977 in having armed scolex, unlobed vitellarium and sac like uterus.

| | | |
|---|---|---|
| Host | - | *Mystus tengra* |
| Habitat | - | Intestine |
| Locality | - | Jhansi |
| Holotype | - | P.G. Department of Zoology |
| | | Bipin Bihari College, Jhansi |

**Comparison of the Characters of *Philobythos atlanticus* Campbell , 1977 to *Philobythos prasadi* n. sp.**

| *Philobythos atlanticus* Campbell, 1977 | *Philobythos prasadi* n.sp. |
|---|---|
| 1. Scolex unarmed | 1. Scolex armed |
| 2. Ovary compact. | 2. Ovary bilobed not compact. |
| 3. Vitellarium lobated | 3. Unlobed Vitellarium |
| 4. Triangular uterus | 4. Sac like uterus |
| 5. Parasite of marine fishes | 5. Parasite of fresh water fishes. |

## EXPLANATION OF PLATE-4

| | |
|---|---|
| PLATE-4 | *Philobythos prasadi* n.sp. |
| Fig.-1 | Scolex with neck (5x10) |
| Fig.-2 | Hooks (15x10) |
| Fig.-3 | Immature Proglottids (5x10) |
| Fig.-4 | Mature Proglottids (5x10) |
| Fig.-5 | Gravid Proglottids (5x10) |

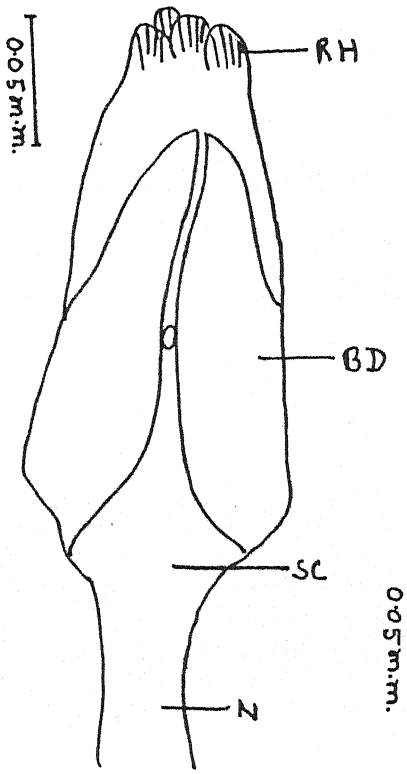



Fig-1

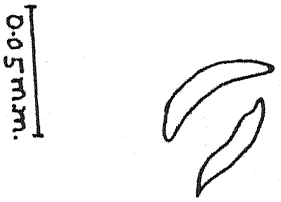



Fig-2

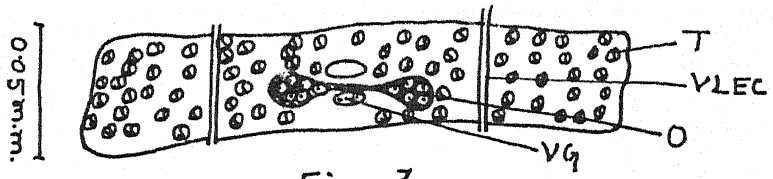



Fig-3

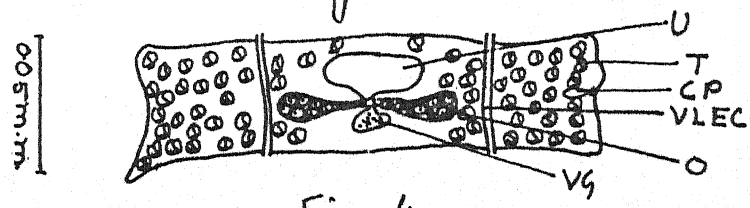



Fig-4

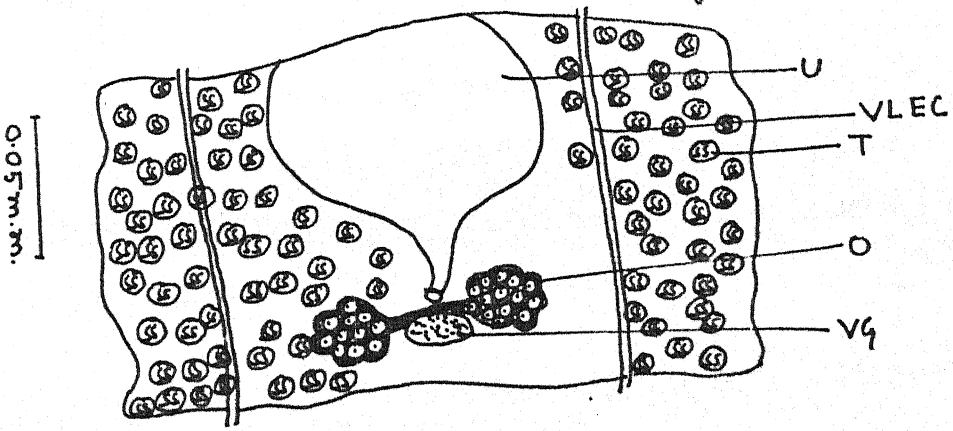



Fig-5

# PLATE - 4

**Order - Pseudophyllidea Carus, 1863**

**Family - Philobythiidae Campbell, 1977**

**Genus - *Sukhobythos* n.g.**

**Species - *Sukhobythos capoori* n.g., n.sp.**

**(Plate 5, Figs. 1-5)**

Out of seven *Mastacembellus armatus* (Laceped) two yieled five cestodes in its intestine. Morphological studies of cestode revealad them to belong to a new genus *Sukhobythos* n.g. and a new sepcies *Sukhobythos capoori* n.g. , n.sp. of the family Philobythiidae Campbell, 1977 order Pseudophyllidea Carus, 1863.

Scolex well developed measures 0.104-0.166X0.008-0.112 (0.15X0.092). Rostellar hooks 0.04-0.07(0.06) in length . Neck present measures 0.060-0.072(0.066) in length. Proglottids numerous in number, broader than long.

Immature proglottids measure 0.03-0.06X0.183-0.254 (0.034X0.21), mature proglottids measure 0.066-0.09X0.23-0.28 (0.079X0.26) and gravid proglottids measures 0.04-0.08X0.31-0.43 (0.06X0.40). Two sets of male and one set of female reproductive organs present in each proglottid.

Testes oval to round, numerous in number measures 0.006-0.012 (0.0096) in diameter, scattered through out the proglottid and cross the ventral longitudinal excretory canal and even reach upto margin of proglottid. Cirrus pouch double in number one on each side of proglotid margin. Cirrus pouch measure 0.03-0.048X0.024-0.036(0.042X0.030).

Ovary bilobed, dumbell shaped centrally located with a long isthmus measures 0.024-0.036X0.075-0.11 (0.03X0.10). Vitellarium single unlobed transversely elongated measures 0.024-0.036 (0.03) in length. Uterus sac like located in the middle of the proglottid measures 0.06- 0.09(0.07) in diameter, anterior to ovary.

# Discussion

Schmidt G.D., 1986 has included only two genera in family Philobythiidae Campbell 1977. The present form comes closer to the genus *Philobythos Campbell, 1977* in having armed scolex , double sets of male genitalia and bilobed ovary.

Thus the proposed new genus *Sukhobythos* n.g. differs from all the known genera of the family Philobythiidae Campbell, 1977.

In the light of above discussion the *Sukhobythos capoori* n.g. , n.sp. may be provisionaly accommodated in the proposed new genus *Sukhobythos* n.g.

| | | |
|---|---|---|
| **Host** | - | ***Mastacembellus armatus (Lacepede)*** |
| **Habitat** | - | **Intestine** |
| **Locality** | - | **Jhansi** |
| **Holotype** | - | **P.G. Department of Zoology** |
| | | **Bipin Bihari College, Jhansi** |

**Comparison of the Characters of *Philobythos* Campbell, 1977 to *Sukhobythos* n.g.**

| *Philobythos* Campbell, 1977 | *Sukhobythos* (n.g.) |
|---|---|
| 1. Scolex unarmed. | 1. Scolex armed |
| 2. One set of male and one set of female genitalia | 2. Two set of male and one set of female genitalia, |
| 3. Ovary compact | 3. Ovary bilobed. |

## Key to the various genera of the family -

## Philobythiidae Campbell , 1977

1. Strobilla with internal segmentation present. More than one set of reproductive organs present.....2

2. Scolex with no true suckers, bothria, bothirdia or tantacles. No external segmentation.....Spathebothriidae, Wardle and Mc Leod, 1952.

   Scolex with one of the holdfast types listed above. External segmentation usually distinct.....3

3. Scolex with bothridia and four armed proboscides or tantacles .....Trypanorhyncha Diesing , 1863 .....4

4. Vagina and cirrus pouch opening medial on flat surface.

   Vagina and cirrus pouch opening marginal or submarginal not medial..... .....5

5. Cirrus distinctly protrusible,with large spines. Two sets of reproductive organ per segment.....Echinophallidae, Schumacher, 1914.

   Cirrus not distinctly protrusible nor spined. One set of reprodutive organs per segment .....6

6. Vitellarium single. lobate, transversly elongated, posterior to ovary..... .....Philobythiidae Campbell, 1977 .....7

7. Scolex with apical disc, some testes posterior to ovary.....

.....*Philobythos* Campbell, 1977

Scolex with out apical dise , testes all anterior to ovary .....

.....Philobythoides Campbell 1979

Scolex without apical disc, some testes posterior to ovary.

.....*Shukhobythos* n.g

## EXPLANATION OF PLATE-5

| | |
|---|---|
| PLATE-5 | *Sukhobythos capoori* n.g., n.sp. |
| Fig.-1 | Scolex with neck (5x10) |
| Fig.-2 | Hooks (15x10) |
| Fig.-3 | Immature Proglottids (5x10) |
| Fig.-4 | Mature Proglottids (5x10) |
| Fig.-5 | Gravid Proglottids (5x10) |

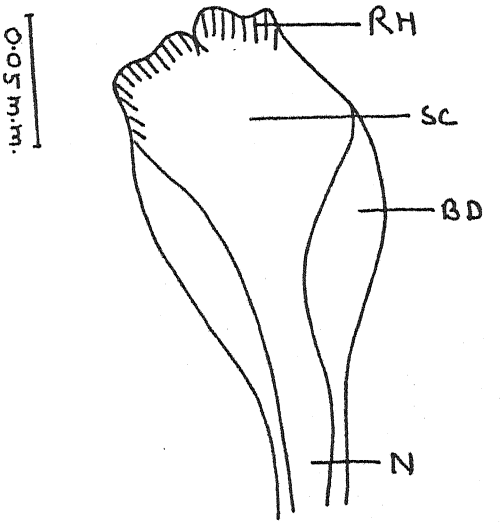



Fig-1

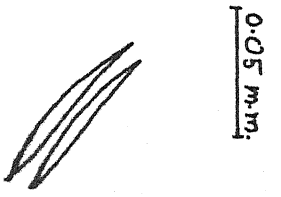



Fig-2

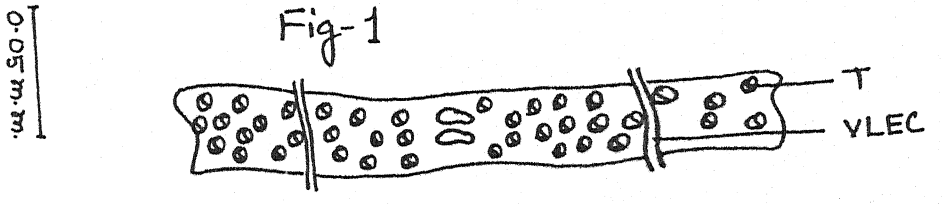



Fig-3

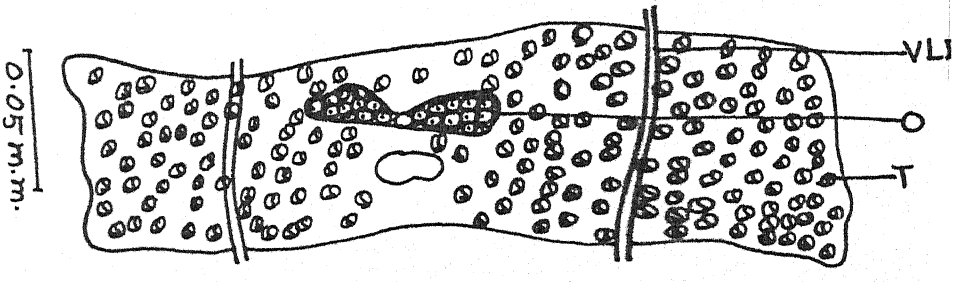



Fig-4

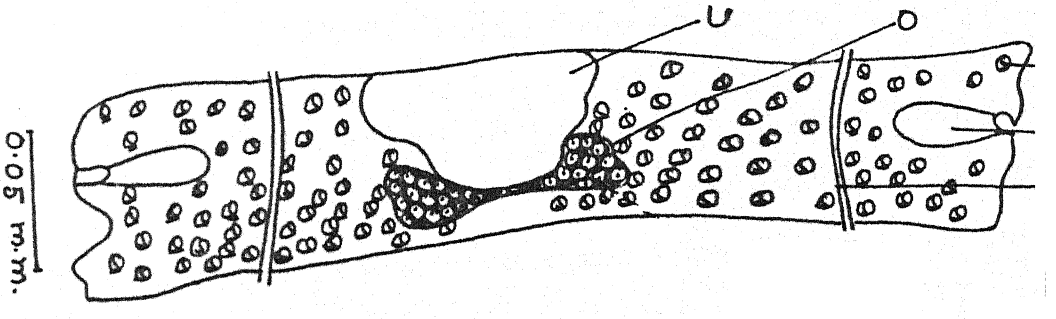



Fig-5

# PLATE - 5

| | | |
|---|---|---|
| Order | - | **Pseudophyllidea Carus, 1863** |
| Family | - | **Jalpiidae n.f.** |
| Genus | - | ***Jalpos* n.g.** |
| Species | - | ***Jalpos pahujensis n.g. , n. sp.*** |

**(Plate 6, figs. 1-4)**

Out of five fishes, *Mastacembellus armatus* (Lacepede), two were found infected with three cestode in their intestine. Morphological studies of the cestode revealed them to belong to a new genus *Jalpos* n.g. and a new species *Jalpos pahujensis* n.g. , n.sp. of the new family Jalpiidae n.f. , order pseudophyllidea Carus, 1863.

## JALPIIDAE N.F. DIAGNOSIS

Scolex armed. Bothria distinct. Neck present. Metamerism distinct. Strobila with velum. Genital openings median. Seminal vesicles absent. Testes numerus. Ovary bilobed . each lobe is further lobulated. Vagina posterior to cirrus pouch, Vitellaria laterally located, crosses the ventral longitudinal excretory canals. Uterus sac like. Eggs present.Parasite of fresh water fish type Genus - *Jalpos* n.g.

## GENERIC DIAGONOSIS

Worm large sized. Scolex well developed with two bothria. Neck present . Gonopore separate. Cirrus pouch well developed. Seminal vesicles absent . Testes in two fields cross the ventral longitudinal excretory canals. Ovary bilobed. Each lobe is further lobulated. Vitellaria folicular and laterally located.

## *Jalpos pahujensis* n.g., n.sp.

Scolex well developed, narrow anteriorly and broad posteriorly, measures 0.21-0.26 X 0.044 - 0.108 (0.224 X 0.076), sac like two bothria measures 0.228-0.264 X 0.012-0.030 (0.24 X 0.018). Rostellum with 22-28 hooks, Hooks measures 0.03-0.05 (0.04) in

length. Neck present measures 0.118-0.288(0.21) in length.

Proglottids broader than long. Immature proglottids measure 0.05-0.07 X 0.122-0.156 (0.062X0.134), mature proglottids measure 0.055-0.078 X 0.128-0.168 (0.071 X 0.144) and gravid proglottids measure 0.1-0.14X0.20-0.25 (0.108X0.23).

Testes oval to round, numerous in number, measures 0.005-0.018 (0.015), scattered through out the proglottid in two laterals fields and cross the ventral logitudinal excretory canals. Cirrus pouch oval shaped measuers 0.012-0.036 (0.024) and alternately arranged.

Female genitalia posteriorly located.Ovary bilobed measures 0.018-0.036X0.041-0.108 (0.021X0.062), each lobe is further lobulated. Vitelline follicles measures 0.006-0.012 (0.008) in diameter laterally located near the margin of the proglottids.

Genital openings median. Uterus located in the middle of the proglottid, anterior to the ovary measures 0.062-0.108X0.06-0.09 (0.086-0.078).

| | | |
|---|---|---|
| **Host** | - | ***Mastacembellus armatus* (Lacepede)** |
| **Habitat** | - | **Intestine** |
| **Locality** | - | **Pahuj Dam** |
| **Holotype** | - | **P.G. Department of Zoology, Bipin Bihari College,Jhansi** |

## Key to the new family - Jalpiidae

1. Strobilla with internal segmentation present. More than one set of reproduetive organs present.....2

2. Scolex with no true suckers, bothria, bothridia or tentacles. No external segmentation.....Spathe bothriidea Wardle and McLeod, 1952
Scolex with one of the holdfast types listed above. External segmentation usually distinct.....3

3. Scolex with bothridia and four armed proboscides or tantacles .....Trypanorhyncha Diesing , 1863 Scolex with two bothria, tantacles rarely present .....Pseudophyllidea Carus, 1863

4. Vagina and cirrus pouch opening medial on flat surface vagina and cirrus pouch opening marginal or sub marginal not medial .....5

5. Cirrus distinctly protrusible with large spines Two sets of reproductive organs per segment.....Echinophallidae Schumacher, 1914
Cirrus not distinctly protrusible nor spined. One set of reproduetive organ par segment .....6

6. Vitellarium single , lobate, transversly elongated posterior to ovary ..... Philobythiidae Campbell , 1977
Vitellaria follicular, laterally located.....Jalpiidae n.f.
Vitellarium follicular, not compect and posteior to ovary. .

## EXPLANATION OF PLATE-6

| | |
|---|---|
| PLATE-6 | *Jalpos pahujensis* n.g., n.sp. |
| Fig.-1 | Scolex with neck (5x10) |
| Fig.-2 | Hooks (15x10) |
| Fig.-3 | Mature Proglottids (5x10) |
| Fig.-4 | Gravid Proglottids (5x10) |

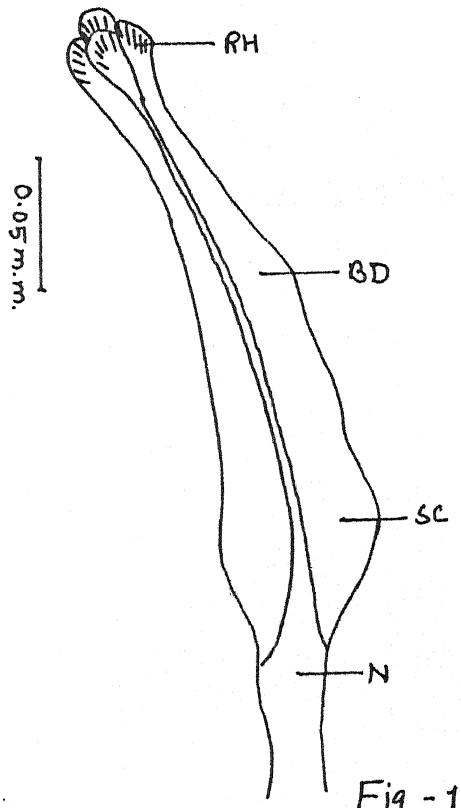



Fig - 1

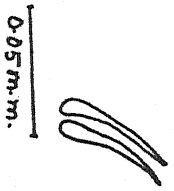



Fig - 2

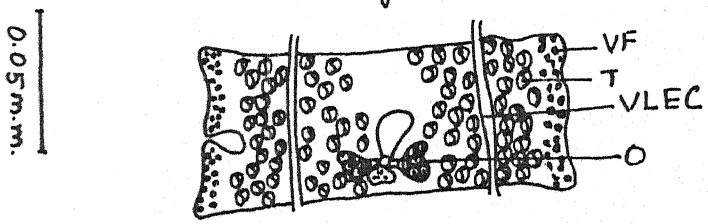



Fig - 3

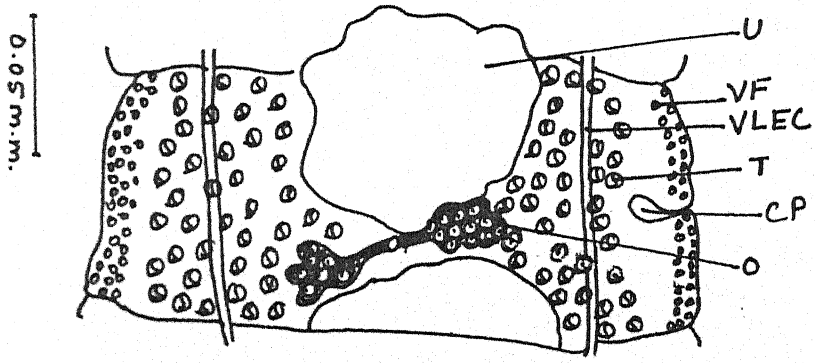



Fig - 4

# PLATE - 6

# ABBREVIATIONS

| | | |
|---|---|---|
| AO | - | Apical organs |
| APR | - | April |
| AUG | - | August |
| BD | - | Bothridia |
| C | - | Cirrus |
| CP | - | Cirrus pouch |
| DEC | - | December |
| E | - | Egg |
| ESR | - | Erthrocyte sedimentation rate |
| FEB | - | February |
| Hb | - | Haemoglobin |
| JAN | - | January |
| JUN | - | June |
| MAR | - | March |
| MCH | - | Mean corpuscular haemoglobin |
| MCHC | - | Mean corpuscular haemoglobin concentration |
| N | - | Neck |
| NOV | - | November |
| O | - | Ovary |
| OCT | - | October |
| PCV | - | Packed cell volume |
| RBC | - | Red blood cell |
| RH | - | Rostellar hook |
| SC | - | Scolex |
| SEP | - | September |

| | | |
|---|---|---|
| T | - | Testes |
| TEC | - | Total erythrocyte count |
| TEMP | - | Temperature |
| TLC | - | Total leucocyte count |
| U | - | Uterus |
| VD | - | Vas deferens |
| VF | - | Vitelline follicles |
| VG | - | Vitelline gland |
| VLEC | - | Ventral longitudinal excretory canal |
| WBC | - | White blood cell |

# PART-C

# ECOLOGICAL OBSERVATION

To study the nature of cestode infection in fresh water fish, *Channa punctatus* (Bloch), One hundred ten fishes were examined for two successive years since sep. 93 to Aug. 95 Out of 110 hosts examined only 7 were found infected with 17 cestodes . Thus the average annual prevalance of cestode infection in the *Channa* fish was (0.063) . Mean intensity (2.42) and the relative density (0.154) . Nematodes were not obtained from any *Channa* fish so the prevalence of nematode infection, mean intensity and relative density was nill. Only 26 trematodes were found from 8 fishes. Thus the prevalence of trematode infection was (0.072). mean intensity (3.25) and relative density (0.236) . Only 116 acanthocephala were obtained from 47 fishes . Thus the prevalence of acanthocephala infection was (0.427) , mean intensity (2.46) and relative density (1.054). {Table No. 1, Graph No.1}

Average seasonal variation in the prevalence , mean intensity and relative density of cestode infection in *Channa* fishes were as follows.

The prevalence of cestode infection was highest during summer season (0.090) and lowest in rainy season (0.032). The mean intensity of cestode infection was highest during summer and winter (2.5) and lowest during rainy (2.0). The relative density of cestode infection was also highest in summer (0.227) and lowest during rainy (0.664).{Table No.2, Graph No.2} Average monthwise variation in the prevalence, mean intensity and relative density of the cestode infection in *Channa punctatus* have been depicted .The maximum prevalence was recorded in month of April (0.285) where as minimum (0) in December, January, May, June, August and October. In rest of the months it ranges in between (0.066) to (0.20) . The maximum mean intensity (3.0) was recorded in October, December, January, May, June, July, and August. In rest of months (2.0) . The relative density (0.571) was miximum in the month of April where as minimum (0) in October, December, January, May, June, July, and August. In rest of the months it ranges from (0.20) - (0.40).{Table No.3, Graph No.3}

## I. Cestode Infection In Relation To The Body Weight Of The Host

### (a) Average annual variation {Table No.4, Graph No.4}

### 1. Prevalence -

Maximum prevalence of cestode infection (0.102) was recorded in the host ranging from 56 to 110 gm body weight while minimum (0) was recorded in the host ranging from 111 to 165 gm and 166 to 210 gm but (0.055) was recorded in the host ranging from 0 to 55 gm body weight.

### 2. Mean Intensity -

Maximaum mean intensity of cestode infection (92.75) was recorded in the host ranging from 56 To 110 gm body weight while minimum 0 was recorded in the host ranging from 111 to 165 gm. body weight and 166 to 210 gm body weight but 2.0 was recorded in the host ranging from 0 to 55 gm body weight.

### 3. Relative Density -

Maximum relative density (0.282) of cestode infection was recorded in the host ranging from 56 - 110 gm body weight while minimum (0) was recorded in the host ranging from 111 to 165 gm and 166 to 210 gm but (0.111) was recorded in the host ranging from 0 to 55 gm body weight.

### (b) Average seasonal variation - {Table No.5(A, B, C, D), Graph No.5,6,7}

### 1. Prevalence -

The miximum prevalence (0.13) was recorded in the host body weight ranging from 0 to 55 gm during summer.

The minimum prevalence (0) was recorded in the host body weight ranging from 0 to 55 gm during winter and rainy season, 111 to 165 gm during winter summer and rainy season and 166 to 210 gm during summer season.

## 2. Mean Intensity -

The maximum mean intensity of the cestode infection was (4.0) recorded in the host body weight ranging from 56 to 110 gm during summer.

The minimum mean intensity of the cestode infection (0) was recorded in the host body weight ranging from 0 to 55 gm , 111 to 165 gm during winter and 0 to 56 gm, 111 to 165 gm during rainy season . and 111 to 165 gm, 166 to 210 gm during summer.

## 3. Relative Density -

The minimum relative density of cestode infection (0.363) was recorded in the host body weight ranging from 56 to 110 gm during summer.

The minimum relative density of cestode infection (0) was recorded in the host body weight ranging from 0 to 55 gm , 111 to 165 gm during winter and 0 to 55 gm, 111 to 165 during rainy season and 111 to 165 gm, 166 to 210 gm during summer season.

## (c) Average monthwise variation- {Table No.6(A, B, C, D), Graph No.8,9}

## 1. Prevalence -

In the host body weight ranging from 0 to 55 gm the maximum prevalence (0.333) was recorded in April where as minimum (0) in September, October, November, December,January, February, May, June, July, and August. In the host body weight ranging from 56 to 110 gm the maximum prevalence (0.333) was recorded in September where as minimum (0) in October,December January, April, May, June, July, August. In the host body weight ranging from 111 to 165 gm the prevalence is nill and no host of this body weight range was available for examination in January, February, April, May, July, and August. In the body weight ranging from 166 to 220 gm the prevalence is nill and no host of this body weight range was available for examination in all the months except March.

## 2. Mean Intensity -

In the host body weight ranging from 0 to 55 gm, the maximum mean intensity (2.0) was recorded in the months of March and April while minimum (0) in September, October, November, December, January, February, May, June, July, August. In the host body weight ranges 56 - 110 gm the maximum mean intensity (4.0) was recorded in March where as minimum (0) was recorded in October,December, January, April, May, June, July and August. In the host body weight ranging from 111 - 165 gm the mean intensity was nill and no host of this body weight range was available for examination in January, February, April, May, July, August. In the host body weight ranging from 166 to 220 gm the mean intensity was nill and no host of this body weight range was available for examination in all the months except the month of March.

## 3. Relative Density -

In the host body weight ranging from 0.55 gm, the maximum relative density (0.666) was recorded in April while minimum (0) in September, October, November, December, January, February, May, June, July, August. In the host body weight ranging from 56 to 110 gm the maximum relative density (1.0) was recorded in February and March while minimum (0) in October, December, January, April, May, June, July and August. In the host body weight ranging from 111 to 165 gm the relative density was nill and no host of this body weight range was available for examination in January, February, April, May, July and August. In the host body weight ranging from 166-220 gm the relative density is nill and no host of this body weight range was available for examination in all months except March.

# II. Cestode Infection In Relation To The Sex Of The Host -

{Table No.7, Graph No.10}

### (a) Average annual variation-

### 1. Prevalence -

The prevalence of cestode infection was (0.036) in males and (0.090) in females.

### 2. Mean Intensity -

The mean intensity of cestode infection was (2.5) in males and (2.4) in females.

### 3.Relative Density-

The relative density of cestode infection was (0.090) in males and (0.218) in females.

### (b) Average seasonal variation- {Table No.8(A, B), Graph No.11,12}

### 1. Prevalence-

### In Males-

The maximum prevalence (0.0625) was recorded in winter while minimum (0) in rainy season.

### In Females-

The Maximum prevalence (0.136) was recorded in summer while minimum (0.0526) in rainy season.

### 2. Mean Intensity-

### In Males-

The maximum mean intensity (3.0) was recorded in winter while minimum (0) in rainy season.

### In Females-

The maximum mean intensity (2.66) was recorded in summer while minimum (2.0) in winter and rainy season.

### 3. Relative Density-

### In Males-

The maximum relative density (0.187) was recorded in winter while minimum (0) in rainy season.

### In Females-

The maximum relative density (0.363) was recorded in summer while minimum (0.105) in winter.

### (c) Average monthwise variation- {Table No.9(A, B), Graph No.13,14}

### In Males-

### 1. Prevalence -

The maximum prevalence (0.142) was recorded in November while minimum (0) was recorded in September, October, December, January, February, April, May, June, August. In March it ranges from (0.083).

### 2. Mean Intensity -

The maximum mean intensity (3.0) was recorded in November while minimum (0) was recorded in September, October, December, January, February, April, May, June, July and August, and in March it ranges (2.0).

### 3. Relative Density -

The maximum relative density (0.428) was recorded in November while minimum

(0) in September, October, December, January, February, April, May,June and August in March it ranges (0.15).

### In Females-

### 1. Prevalence-

The maximum prevalence (0.5) was recorded in the month of April while minimum (0) in October, November, December, January, May, June July and August. In rest of the month it ranges from (0.142) to (0.333).

### 2. Mean Intensity-

The maximum mean intensity (4.0) in March while minimum (0) in October, November, December, January, May, June and August. In rest of the month September, February, April it ranges (2.0).

### 3. Relative Density -

The maximum relative density (1.0) was recorded in April while minimum (0) in October, November, December, January, May, June, July and August. In rest of the months it ranges from (0.571) to (0.666).

## III. Cestode Infection In Relation To The Cloacal Temperature Of The Host -

{Table No.10, Graph No.15}

### (a) Average annual variation

### i. Prevalence -

Maximum prevalence of cestode infection (0.081) was recorded in the host ranging from 76- 80$^0$ F cloacal temperature while minimum (0.035) in the host cloacal temperature ranging from 66 - 70$^0$ F.

### ii. Mean Intensity -

Maximum mean intensity of cestode infection (2.5) was recorded in the host ranging from 71 - 75$^0$ F and 76 - 80$^0$ F for cloacal temperature while minimum (2.0) was recorded in the host ranging from 66 - 70$^0$ F of cloacal temperature.

### iii. Relative Density -

Maximum relative density of cestode infection (0.204) was recorded in the host ranging from 76 - 80$^0$ F cloacal temperature while minimum (0.071) in the host ranging from 66 - 70$^0$F cloacal temperature.

### (b) Average seasonal variation- {Table No.11(A, B, C), Graph No.16,17}

### i. Prevalence-

The maximum prevalence (0.1) was recorded in the host cloacal temperature ranging from 66 - 70$^0$ F in summer season.

The minimum prevalence (0.071) was recorded in the host cloacal temperature ranging 76-80$^0$ F in winter.

### ii. Mean Intensity -

The maximum mean intensity (0) was recorded in the host cloacal temperature ranging from 71 - 75$^0$ F in summer and cloacal temperature ranging from 76 - 80$^0$ in winter.

The minimum mean intensity of cestode infection (2.0) was recorded in host cloacal temperature ranging from 66 - 70$^0$ F in summer and 71 - 75$^0$ F in winter and 76 - 80$^0$ F in rainy season.

### iii. Relative Density -

The maximum relative density (0.272) was recorded in the cloacal temperature ranging from 71 - 75$^0$ F in summer. The minimum relative density (0.166) was recorded

in the host cloacal temperature ranging from 71 -75$^0$ F in winter and 76 -80$^0$ F in rainy season.

**(C) Average monthwise variation -** {Table No.12(A, B, C), Graph No.19,20,21}

**i. Prevalence -**

Fishes having 66 - 77$^0$ F cloacal temperature could not be persist in July and August but only in the month of March. Only one host showed infection having two cestodes and the prevalence was (0.02).

In the host having cloacal temperature ranging from 71 -75$^0$ F the prevalence (0.142) was recorded in the month of November and March. This temperature could not persist in August. In the host having cloacal temperature ranging from 76 -80$^0$ F the maximum prevalence (0.66) was recorded in April while minimum (0.25) was recorded in September.

**ii . Mean Intensity -**

Fishes having 66 -70$^0$ F cloacal temperature showed only one infection in the month of March and the mean intensity (2.0) was recorded. This temperature could not persist in July and August.

In the host having cloacal temperature ranging from 71 -75$^0$ F the maximum mean intensity (4.0) in March while minimum (3.0) in November was recorded .This temperature could not persist in August. In the host having cloacal temperature ranging from 76 -75$^0$ F . The mean intensity (2.0) was recorded in September,February and April.

**iii. Relative Density -**

Fishes having 66 -70$^0$ F cloacal temperature showed only one infection in the month of March and the relative density (0.4) was recorded.

This temperature could not persist in July and August.

In the host having cloacal temperature ranging from 71 -75$^0$ F the maximum relative

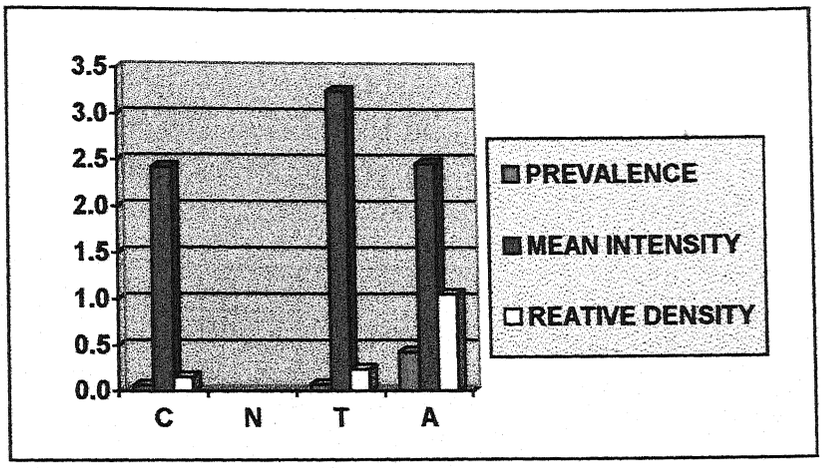
density (0.57) in April while minimum (0.42) was recorded .This temperature could not presist in August. In the host having cloacal temperature ranging from 76 -80$^0$ F the maximum relative density (1.33) in April while munimum (0.5) in September was recorded.

## TABLE NO.-1

## AVERAGE ANNUAL VARIATIONS IN THE PREVALENCE, MEAN INTENSITY AND RELATIVE DENSITY OF HELMINTH INFECTION IN *CHANNA PUNCTATUS* (BLOCH).

| | | |
|---|---|---|
| **No. of Hosts Examined** | | 110 |
| **No. of Hosts Infected with** | Cestode | 7 |
| | Nematode | - |
| | Trematode | 8 |
| | Acanthocephala | 47 |
| **Prevalence of** | Cestode | 0.063 |
| | Nematode | - |
| | Trematode | 0.072 |
| | Acanthocephla | 0.427 |
| **No. of worms obtained** | Cestode | 17 |
| | Nematode | - |
| | Trematode | 26 |
| | Acanthocephala | 116 |
| **Mean intensity of** | Cestode | 2.42 |
| | Nematode | - |
| | Trematode | 3.25 |
| | Acanthocephala | 2.46 |
| **Relative density of** | Cestode | 0.154 |
| | Nematode | - |
| | Trematode | 0.236 |
| | Acanthocepahla | 1.054 |

## GRAPH NO. - 1




C - Cestode

T - Trematode

N - Nematode

A - Acanthocephala

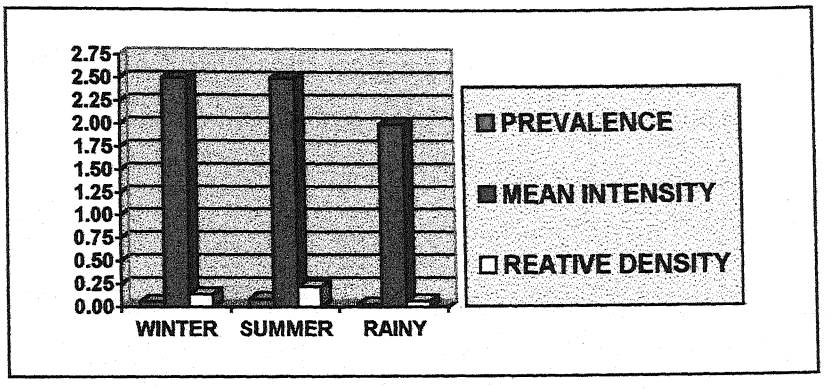
**Average annual variations in the Prevalence, Mean intensity and Relative density of Helminth Infection in *Channa punctatus* (Bloch).**

## TABLE NO.-2

## AVERAGE SEASONAL VARIATIONS IN THE PREVALENCE, MEAN INTENSITY AND RELATIVE DENSITY OF CESTODE INFECTION IN *CHANNA PUNCTATUS* (BLOCH.) .

| Season | No. of Hosts | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Winter | 35 | 2 | 0.057 | 5 | 2.5 | 0.143 |
| Summer | 44 | 4 | 0.090 | 10 | 2.5 | 0.227 |
| Rainy | 31 | 1 | 0.032 | 2 | 2.0 | 0.064 |

## GRAPH NO. - 2



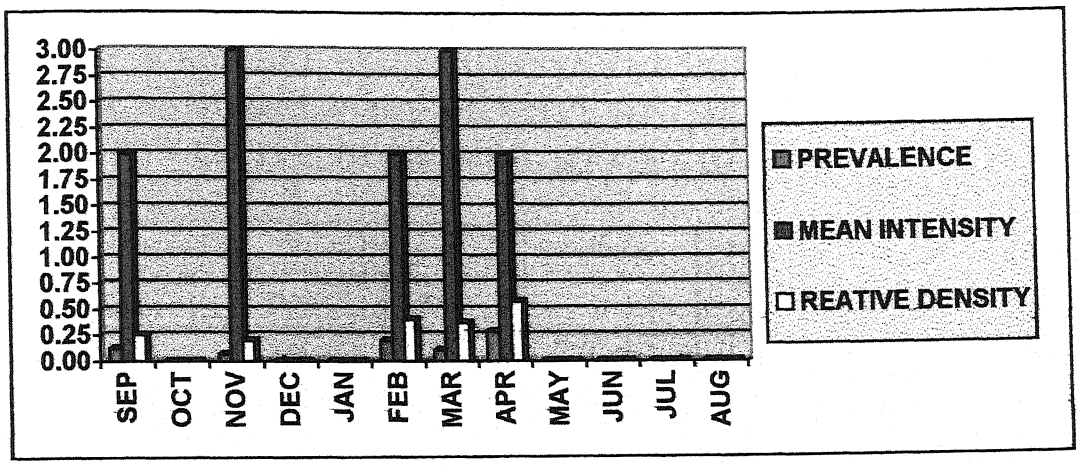

**Annual seasonal variations in the Prevalence, Mean intensity and Relative density of cestode Infection in *Channa punctatus* (Bloch).**

## TABLE NO.3

## AVERAGE MONTHWISE VARIATIONS IN THE PREVALENCE, MEAN INTENSITY AND RELATIVE DENSITY OF CESTODE INFECTION IN *CHANNA PUNCTATUS* (BLOCH.).

| Month/year | No. of Host | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Sep. (93+94) | 8 | 1 | 0.125 | 2 | 2.0 | 0.250 |
| Oct. (93+94) | 14 | 0 | 0 | 0 | 0 | 0 |
| Nov. (93+94) | 15 | 1 | 0.066 | 3 | 3.0 | 0.20 |
| Dec. (93+94) | 10 | 0 | 0 | 0 | 0 | 0 |
| Jan. (94+95) | 5 | 0 | 0 | 0 | 0 | 0 |
| Feb. (94+95) | 5 | 1 | 0.20 | 2 | 2.0 | 0.4 |
| Mar (94+95) | 19 | 2 | 0.105 | 6 | 3.0 | 0.367 |
| April (94+95) | 7 | 2 | 0.285 | 4 | 2.0 | 0.571 |
| May (94+95) | 9 | 0 | 0 | 0 | 0 | 0 |
| June (94+95) | 9 | 0 | 0 | 0 | 0 | 0 |
| July (94+95) | 5 | 0 | 0 | 0 | 0 | 0 |
| Aug. (94+95) | 4 | 0 | 0 | 0 | 0 | 0 |

## GRAPH NO. - 3



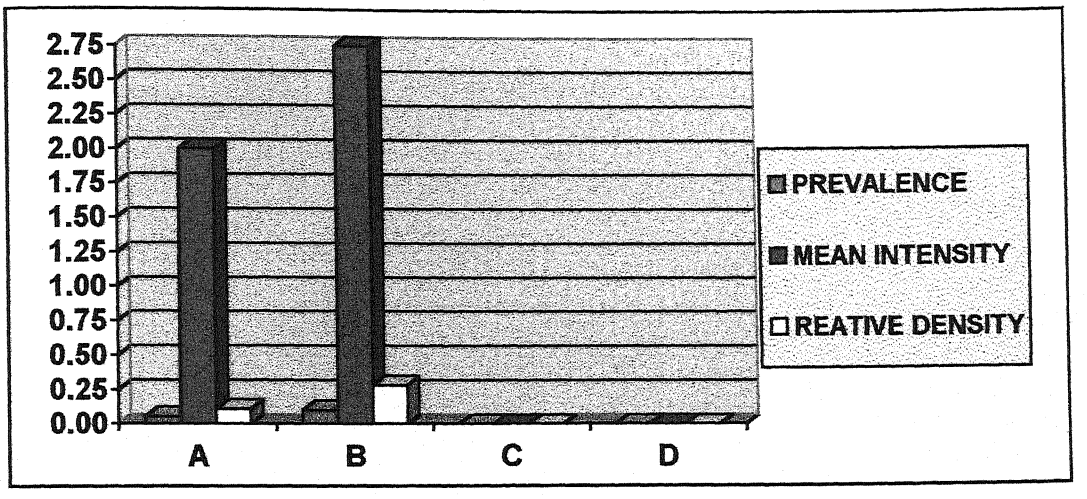

**Average monthwise variations in the Prevalence, Mean intensity and Relative density of cestode Infection in *Channa punctatus* (Bloch).**

## TABLE NO. 4

## AVERAGE ANNUAL VARIATIONS IN THE PREVALENCE, MEAN INTENSITY AND RELATIVE DENSITY OF CESTODE INFECTION IN RELATION TO THE BODY WEIGHT OF THE HOST.

| Group | Range of the body wt. | No. of Hosts | | Prevalence | No. of cestode obtained | Mean Intensity | Relative Density |
|---|---|---|---|---|---|---|---|
| | | Examined | Infected | | | | |
| A | 0-55 gm | 54 | 3 | 0.055 | 6 | 2.0 | 0.111 |
| B | 56-110 gm | 39 | 4 | 0.102 | 11 | 2.75 | 0.282 |
| C | 111-165 gm | 14 | 0 | 0 | 0 | 0 | 0 |
| D | 166-220 gm | 3 | 0 | 0 | 0 | 0 | 0 |

## GRAPH NO. - 4




A = 0-55 gm body weight

B = 56-110 gm body weight

C = 110-165 gm body weight

D = 166-220 gm body weight

**Average annual variations in the Prevalence, Mean intensity and Relative density of cestode Infection in relation to the body weight of the host.**

## TABLE NO.5(A,B,C,D)

## AVEARAGE SEASONAL VARIATIONS IN THE PREVALENCE, MEAN INTENSITY AND RELATIVE DENSITY OF CESTODE INFECTION IN RELATION TO THE BODY WEIGHT OF THE HOST

## A. BODY WEIGHT OF THE HOST 0-55 gm

| Season | No. of Hosts | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Winter | 15 | 0 | 0 | 0 | 0 | 0 |
| Summer | 23 | 3 | 0.13 | 6 | 2.0 | 0.26 |
| Rainy | 16 | 0 | 0 | 0 | 0 | 0 |

## B. BODY WEIGHT OF THE HOST 56 - 110 gm

| Season | No. of Hosts | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Winter | 16 | 2 | 0.125 | 5 | 2.5 | 0.312 |
| Summer | 11 | 1 | 0.090 | 4 | 4.0 | 0.363 |
| Rainy | 12 | 1 | 0.083 | 2 | 2.0 | 0.166 |

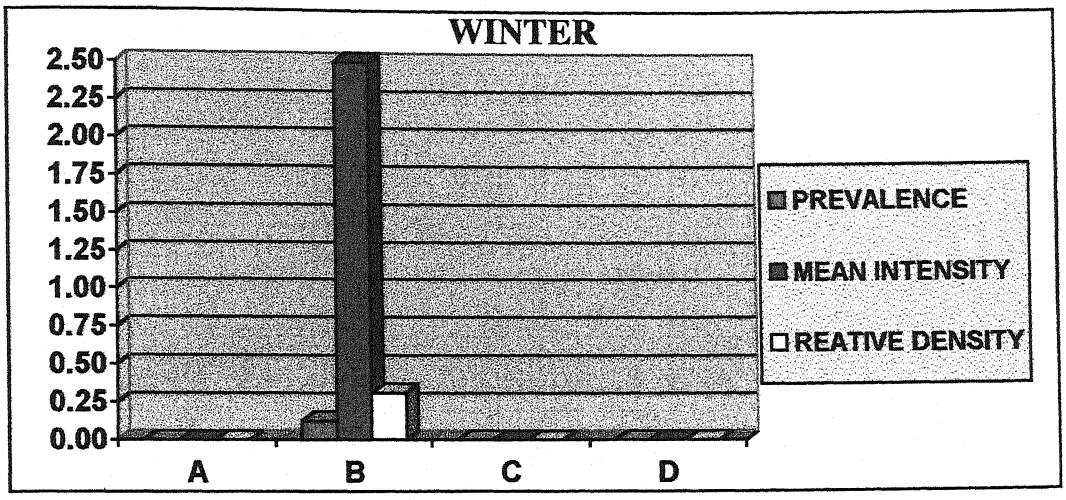
## C. BODY WEIGHT OF THE HOST 111-165 gm

| Season | No. of Hosts | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Winter | 4 | 0 | 0 | 0 | 0 | 0 |
| Summer | 7 | 0 | 0 | 0 | 0 | 0 |
| Rainy | 3 | 0 | 0 | 0 | 0 | 0 |

## D. BODY WEIGHT OF THE HOST 166-220 gm

| Season | No. of Hosts | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Winter | - | - | - | - | - | - |
| Summer | 3 | 0 | 0 | 0 | 0 | 0 |
| Rainy | - | - | - | - | - | - |

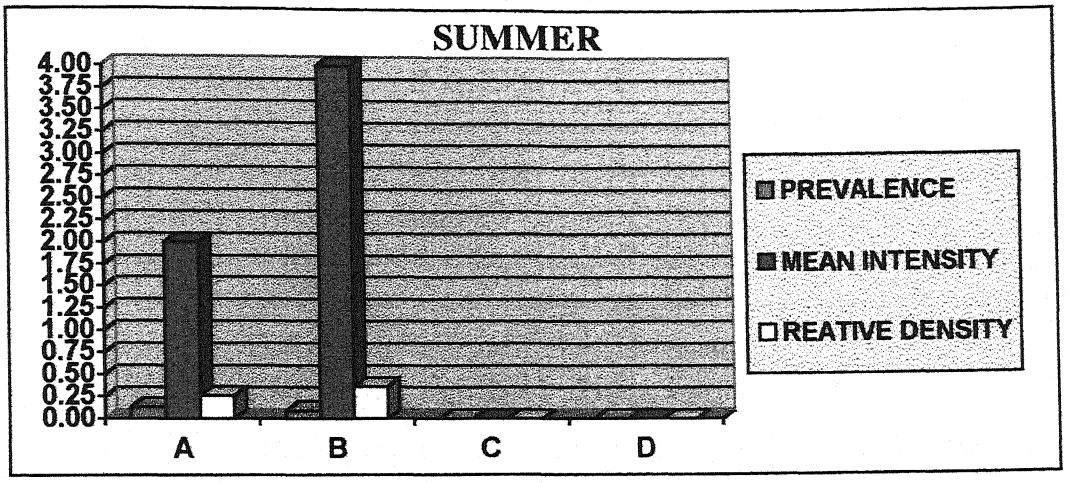
## GRAPH NO. - 5




A = 0-55 gm body weight
B = 56-110 gm body weight
C = 110-165 gm body weight
D = 166-220 gm body weight

**Average seasnol variations winter in the Prevalence, Mean intensity and Relative density of cestode Infection in relation to the body weight of the host.**

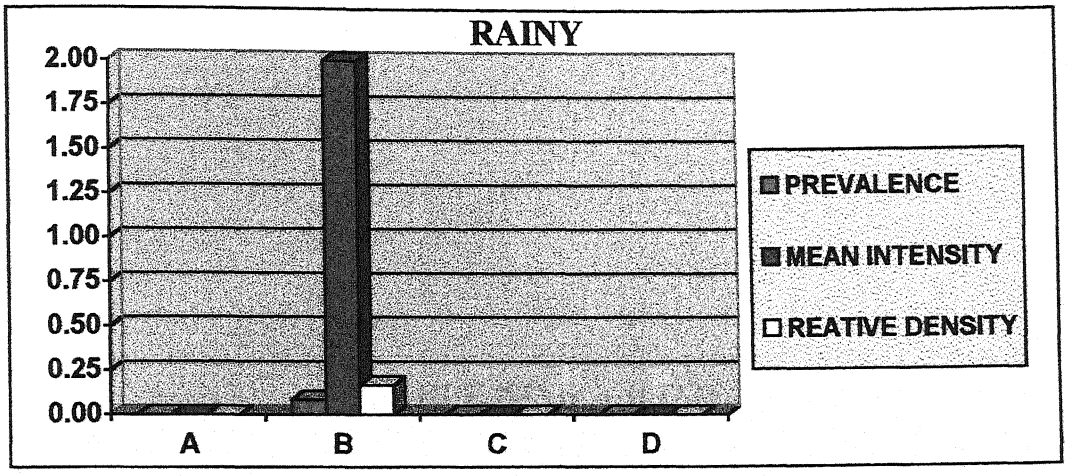
## GRAPH NO. - 6




A = 0-55 gm body weight
B = 56-110 gm body weight
C = 110-165 gm body weight
D = 166-220 gm body weight

**Average seasnol variations summer in the Prevalence, Mean intensity and Relative density of cestode Infection in relation to the body weight of the host.**

## GRAPH NO. - 7




A = 0-55 gm body weight
B = 56-110 gm body weight
C = 110-165 gm body weight
D = 166-220 gm body weight

**Average seasnol variations rainy in the Prevalence, Mean intensity and Relative density of cestode Infection in relation to the body weight of the host.**

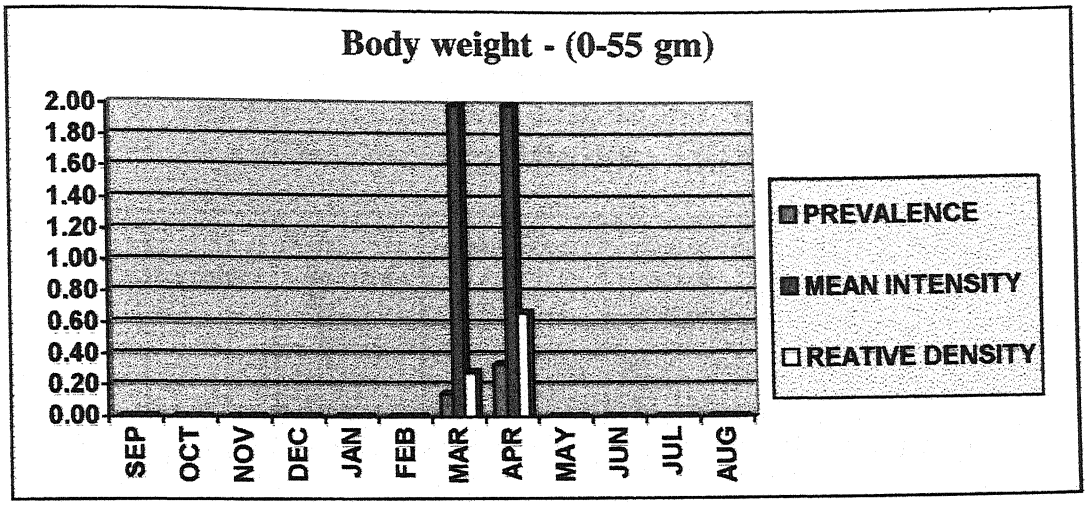
## TABLE NO.6(A,B,C,D)

## AVEARAGE MONTHWISE VARIATIONS IN THE PREVALENCE, MEAN INTENSITY AND RELATIVE DENSITY OF CESTODE INFECTION IN RELATION TO THE BODY WEIGHT OF THE HOST

# TABLE NO.6-A
# BODY WEIGHT OF THE HOST 0-55 gm
# (AVERAGE MONTHWISE VARIATIONS)

| Month/Year | No. of Hosts | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Sep. (93+94) | 4 | 0 | 0 | 0 | 0 | 0 |
| Oct. (93+94) | 7 | 0 | 0 | 0 | 0 | 0 |
| Nov. (93+94) | 6 | 0 | 0 | 0 | 0 | 0 |
| Dec. (93+94) | 5 | 0 | 0 | 0 | 0 | 0 |
| Jan. (94+95) | 2 | 0 | 0 | 0 | 0 | 0 |
| Feb. (94+95) | 2 | 0 | 0 | 0 | 0 | 0 |
| Mar (94+95) | 7 | 1 | 0.142 | 2 | 2.0 | 0.285 |
| April (94+95) | 6 | 2 | 0.333 | 4 | 2.0 | 0.666 |
| May (94+95) | 4 | 0 | 0 | 0 | 0 | 0 |
| June (94+95) | 6 | 0 | 0 | 0 | 0 | 0 |
| July (94+95) | 2 | 0 | 0 | 0 | 0 | 0 |
| Aug. (94+95) | 3 | 0 | 0 | 0 | 0 | 0 |

GRAPH NO. - 8

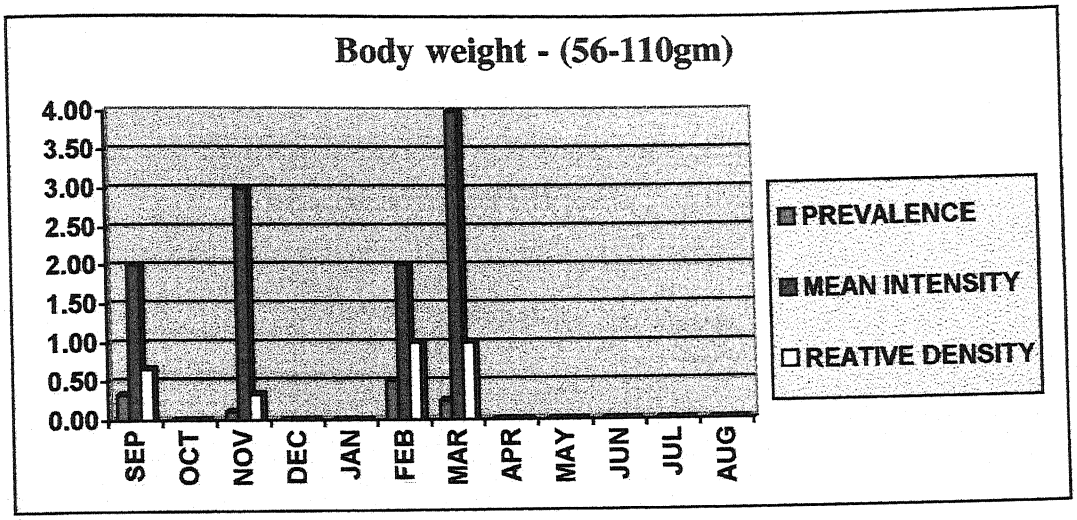



**Average month wise variations in the Prevalence, Mean intensity and Relative density of cestode Infection in relation to the body weight (0-55gm) of the host.**

# TABLE NO. 6-B
# BODY WEIGHT OF THE HOST 56-110 gm
# (AVERAGE MONTHWISE VARIATIONS)

| Month/Year | No. of Hosts | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Sep. (93+94) | 3 | 1 | 0.33 | 2 | 2.0 | 0.66 |
| Oct. (93+94) | 5 | 0 | 0 | 0 | 0 | 0 |
| Nov. (93+94) | 8 | 1 | 0.11 | 3 | 3.0 | 0.33 |
| Dec. (93+94) | 2 | 0 | 0 | 0 | 0 | 0 |
| Jan. (94+95) | 3 | 0 | 0 | 0 | 0 | 0 |
| Feb. (94+95) | 3 | 1 | 0.5 | 2 | 2.0 | 1.0 |
| March (94+95) | 4 | 1 | 0.25 | 4 | 4.0 | 1.0 |
| April (94+95) | 1 | 0 | 0 | 0 | 0 | 0 |
| May (94+95) | 5 | 0 | 0 | 0 | 0 | 0 |
| June (94+95) | 1 | 0 | 0 | 0 | 0 | 0 |
| July (94+95) | 3 | 0 | 0 | 0 | 0 | 0 |
| Aug. (94+95) | 1 | 0 | 0 | 0 | 0 | 0 |

## GRAPH NO. - 9




**Average month wise variations in the Prevalence, Mean intensity and Relative density of cestode Infection in relation to the body weight (56-110gm) of the host.**

# TABLE NO. 6-C
# BODY WEIGHT OF THE HOST 111-165 gm
# (AVERAGE MONTHWISE VARIATIONS)

| Month/Year | No. of Host | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Sep. (93+94) | 1 | 0 | 0 | 0 | 0 | 0 |
| Oct. (93+94) | 2 | 0 | 0 | 0 | 0 | 0 |
| Nov. (93+94) | 1 | 0 | 0 | 0 | 0 | 0 |
| Dec. (93+94) | 3 | 0 | 0 | 0 | 0 | 0 |
| Jan. (94+95) | - | - | - | - | - | - |
| Feb. (94+95) | - | - | - | - | - | - |
| March (94+95) | 5 | 0 | 0 | 0 | 0 | 0 |
| April (94+95) | - | - | - | - | - | - |
| May (94+95) | - | - | - | - | - | - |
| June (94+95) | 2 | 0 | 0 | 0 | 0 | 0 |
| July (94+95) | - | - | - | - | - | - |
| Aug. (94+95) | - | - | - | - | - | - |

# TABLE NO. 6(D)
# BODY WEIGHT OF THE HOST 166-220 gm
# (AVERAGE MONTHWISE VARIATIONS)

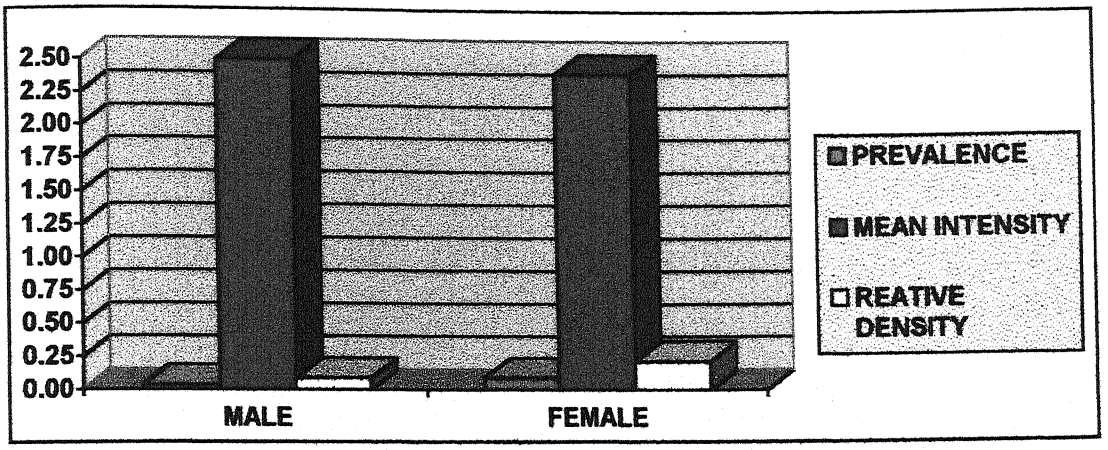
| Month/Year | No. of Hosts | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Sep. (93+94) | - | - | - | - | - | - |
| Oct. (93+94) | - | - | - | - | - | - |
| Nov. (93+94) | - | - | - | - | - | - |
| Dec. (93+94) | - | - | - | - | - | - |
| Jan. (94+95) | - | - | - | - | - | - |
| Feb. (94+95) | - | - | - | - | - | - |
| Mar (94+95) | 3 | 0 | 0 | 0 | 0 | 0 |
| April (94+95) | - | - | - | - | - | - |
| May (94+95) | - | - | - | - | - | - |
| June (94+95) | - | - | - | - | - | - |
| July (94+95) | - | - | - | - | - | - |
| Aug. (94+95) | - | - | - | - | - | - |

## TABLE NO. 7

## AVERAGE ANNUAL VARIATIONS IN THE PREVALENCE, MEAN INTENSITY AND RELATIVE DENSITY OF CESTODE INFECTION IN RELATION TO THE SEX OF THE HOST.

| Sex | No. of Hosts | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Male | 55 | 2 | 0.036 | 5 | 2.5 | 0.090 |
| Female | 55 | 5 | 0.090 | 12 | 2.4 | 0.218 |

## GRAPH NO. - 10




**Average annual variations in the Prevalence, Mean intensity and Relative density of cestode Infection in relation to the sex of the host.**

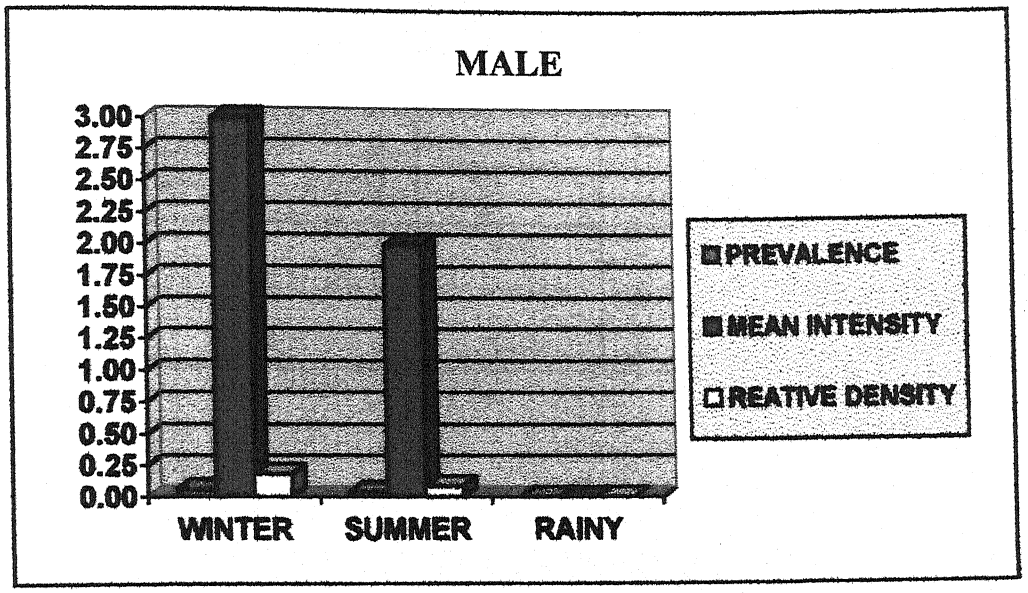
## TABLE NO. 8 (A,B)

## AVERAGE SEASONAL VARIATIONS IN THE PREVALENCE, MEAN INTENSITY AND RELATIVE DENSITY OF CESTODE INFECTION IN RELATION TO THE SEX OF THE HOST.

## TABLE NO. 8 (A)
## MALE HOST

| Season | No. of Hosts | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Winter | 16 | 1 | 0.062 | 3 | 3.0 | 0.187 |
| Summer | 22 | 1 | 0.045 | 2 | 2.0 | 0.09 |
| Rainy | 17 | 0 | 0 | 0 | 0 | 0 |

## GRAPH NO. - 11

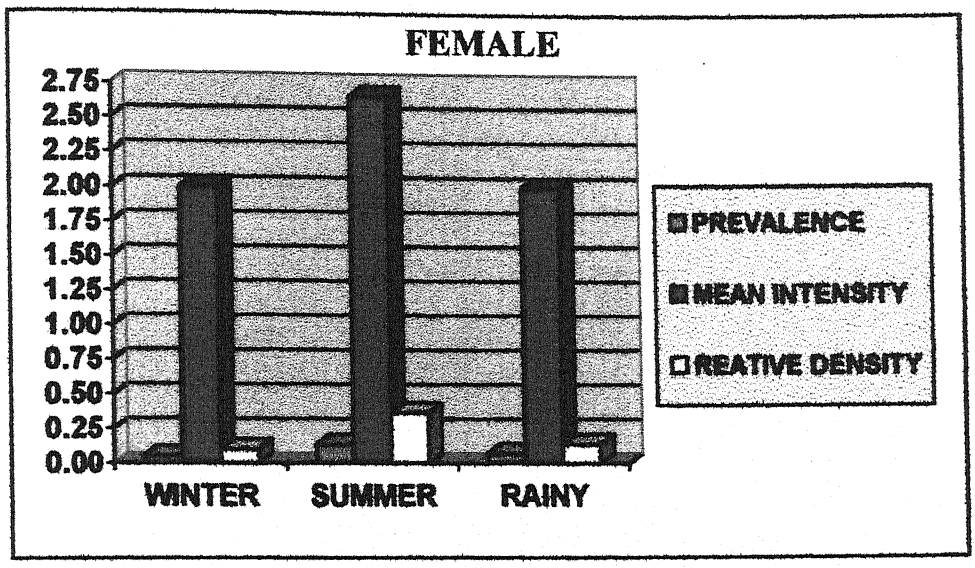



**Average annual variations in the Prevalence, Mean intensity and Relative density of cestode Infection in relation to the male host.**

# TABLE NO. 8 (B)
# FEMALE HOST

| Season | No. of Hosts | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Winter | 19 | 1 | 0.052 | 2 | 2.0 | 0.105 |
| Summer | 22 | 3 | 0.136 | 8 | 2.66 | 0.363 |
| Rainy | 14 | 1 | 0.071 | 2 | 2.0 | 0.142 |

## GRAPH NO. - 12




**Average seasonal variations in the Prevalence, Mean intensity and Relative density of cestode Infection in relation to the female host.**

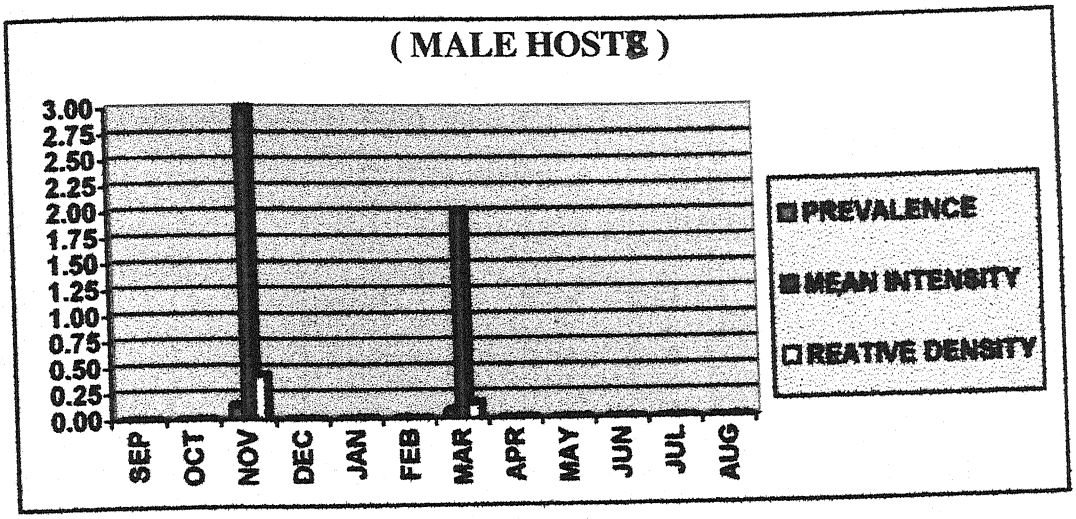
## TABLE NO. 9(A,B)

## AVERAGE MONTHWISE VARIATIONS IN THE PREVALENCE, MEAN INTENSITY AND RELATIVE DENSITY OF CESTODE INFECTION IN RELATION TO THE SEX OF THE HOST.

# TABLE NO. 9(A)
# MALE HOSTS

| Month/Year | No. of Hosts | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Sep.-(93+94) | 5 | 0 | 0 | 0 | 0 | 0 |
| Oct. (93+94) | 7 | 0 | 0 | 0 | 0 | 0 |
| Nov. (93+94) | 7 | 1 | 0.142 | 3 | 3.0 | 0.428 |
| Dec. (93+94) | 4 | 0 | 0 | 0 | 0 | 0 |
| Jan. (94+95) | 3 | 0 | 0 | 0 | 0 | 0 |
| Feb. (94+95) | 2 | 0 | 0 | 0 | 0 | 0 |
| March (94+95) | 12 | 1 | 0.083 | 2 | 2.0 | 0.15 |
| April (94+95) | 3 | 0 | 0 | 0 | 0 | 0 |
| May (94+95) | 4 | 0 | 0 | 0 | 0 | 0 |
| June (94+95) | 3 | 0 | 0 | 0 | 0 | 0 |
| July (94+95) | 3 | 0 | 0 | 0 | 0 | 0 |
| Aug. (94+95) | 2 | 0 | 0 | 0 | 0 | 0 |

## GRAPH NO. - 13

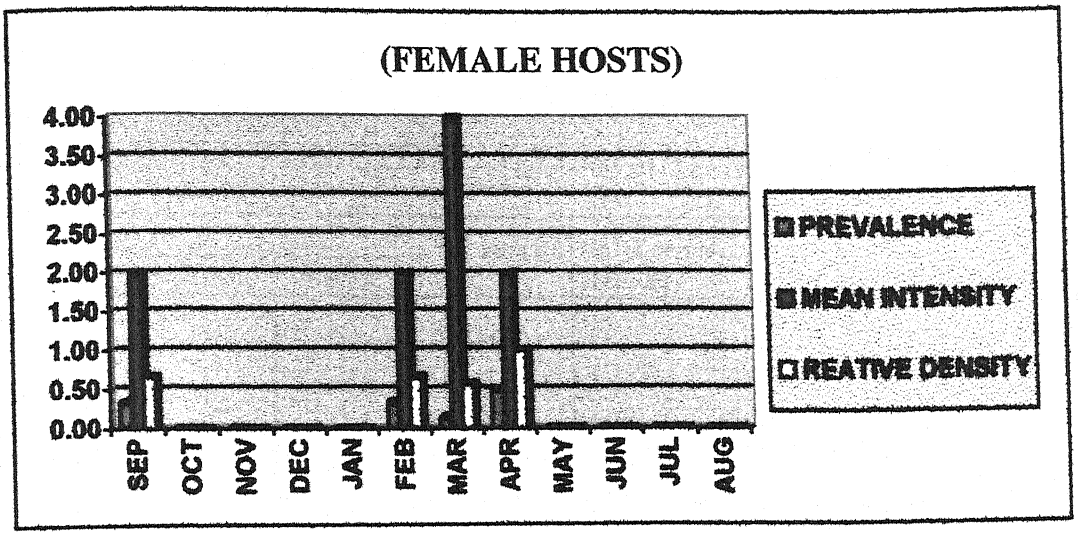



**Average monthwise variations in the Prevalence, Mean intensity and Relative density of cestode Infection in relation to the male host.**

# TABLE NO.9(B)
# FEMALE HOSTS

| Month/Year | No. of Hosts | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Sep. (93+94) | 3 | 1 | 0.333 | 2 | 2.0 | 0.666 |
| Oct. (93+94) | 7 | 0 | 0 | 0 | 0 | 0 |
| Nov. (93+94) | 8 | 0 | 0 | 0 | 0 | 0 |
| Dec. (93+94) | 6 | 0 | 0 | 0 | 0 | 0 |
| Jan. (94+95) | 2 | 0 | 0 | 0 | 0 | 0 |
| Feb. (94+95) | 3 | 1 | 0.333 | 2 | 2.0 | 0.666 |
| Mar (94+95) | 7 | 1 | 0.142 | 4 | 4.0 | 0.571 |
| April (94+95) | 4 | 2 | 0.5 | 4 | 2.0 | 1.0 |
| May (94+95) | 5 | 0 | 0 | 0 | 0 | 0 |
| June (94+95) | 6 | 0 | 0 | 0 | 0 | 0 |
| July (94+95) | 2 | 0 | 0 | 0 | 0 | 0 |
| Aug. (94+95) | 2 | 0 | 0 | 0 | 0 | 0 |

## GRAPH NO. - 14



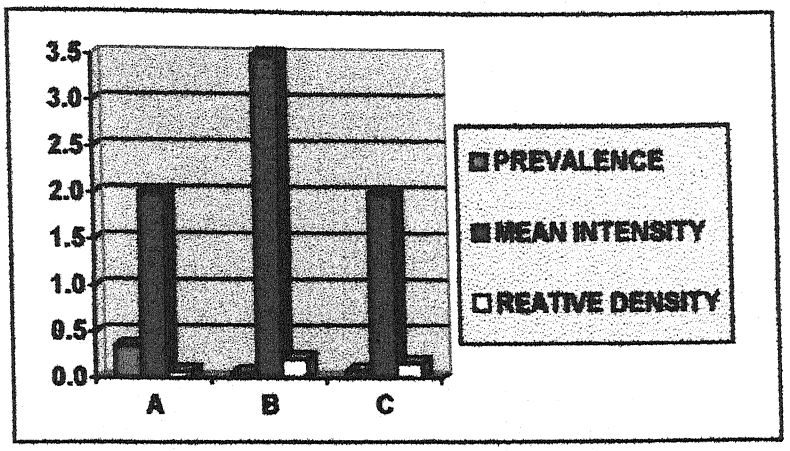

**Average monthwise variations in the Prevalence, Mean intensity and Relative density of cestode Infection in relation to the female host.**

## TABLE NO. 10

## AVERAGE ANNUAL VARIATIONS IN THE PREVALENCE, MEAN INTENSITY AND RELATIVE DENSITY OF CESTODE INFECTION IN RELATION TO THE CLOACAL TEMPRATURE OF THE HOST.

| Cloacal temperature | No. of Hosts | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| A 66-70$^0$ F | 28 | 1 | 0.35 | 2 | 2.0 | 0.071 |
| B 71-75$^0$ F | 33 | 2 | 0.060 | 7 | 3.5 | 0.212 |
| C 76-80$^0$ F | 49 | 4 | 0.081 | 8 | 2.0 | 0.163 |

## GRAPH NO. - 15




A = 66-70$^0$ F

B = 71-75$^0$ F

C = 76-80$^0$ F

**Average annual variations in the Prevalence, Mean intensity and Relative density of cestode Infection in relation to the clocal temp of the host.**

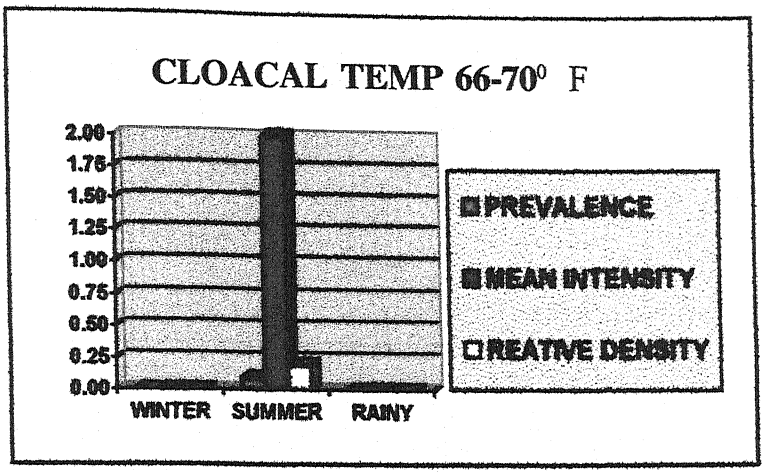
## TABLE NO. 11(A,B,C)

## AVERAGE SEASONAL VARIATIONS IN THE PREVALENCE, MEAN INTENSITY AND RELATIVE DENSITY OF CESTODE INFECTION IN RELATION TO THE CLOACAL TEMPERATURE OF THE HOST.

## TABLE NO. 11(A)
## CLOACAL TEMPERATURE OF THE HOST (66-70$^0$ F)

| Season | No. of Hosts | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Winter | 9 | - | - | - | - | - |
| Summer | 10 | 1 | 0.1 | 2 | 2.0 | 0.2 |
| Rainy | 9 | - | - | - | - | - |

## GRAPH NO. - 16



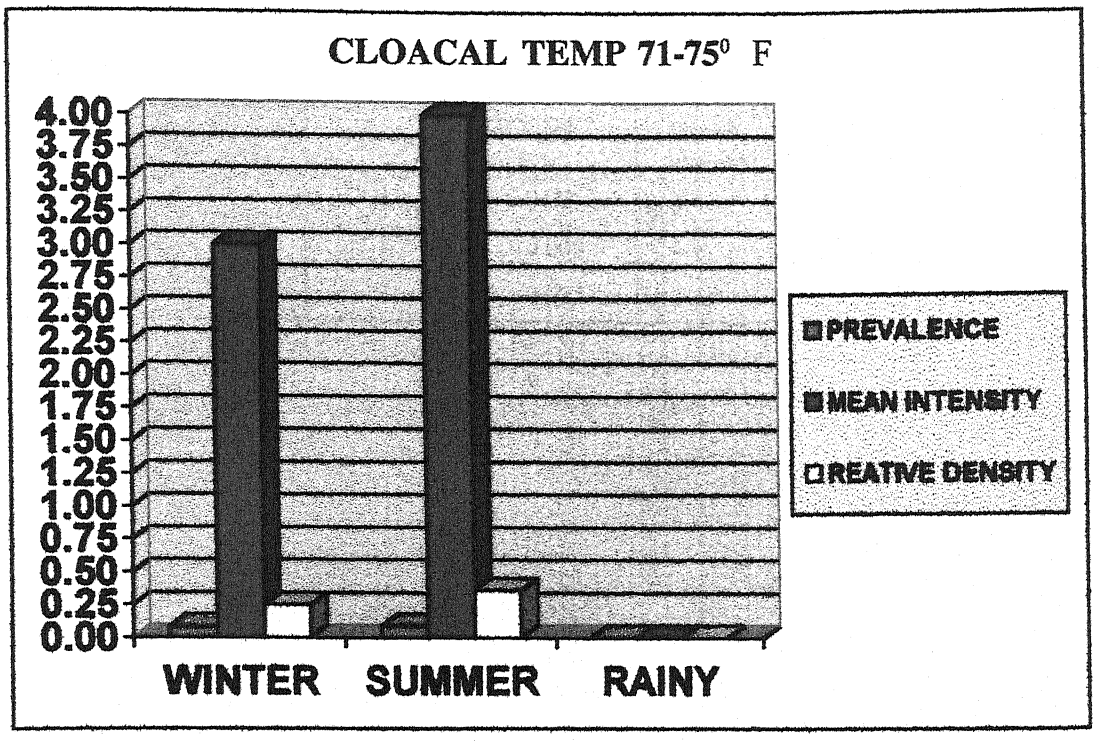

**Average annual variations in the Prevalence, Mean intensity and Relative density of cestode Infection in relation to the clocal temp of the host.**

## TABLE NO. 11(B)

## CLOACAL TEMPERATURE OF THE HOST (71-75$^0$ F)

| Season | No. of Hosts | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Winter | 12 | 1 | 0.083 | 3 | 3.0 | 0.25 |
| Summer | 11 | 1 | 0.090 | 4 | 4.0 | 0.363 |
| Rainy | 10 | - | - | - | - | - |

GRAPH NO. - 17



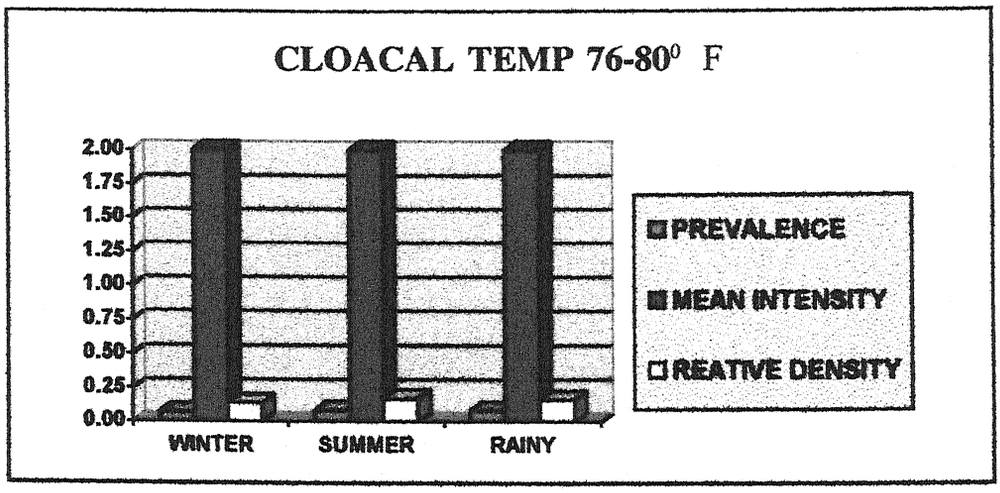

**Average annual variations in the Prevalence, Mean intensity and Relative density of cestode Infection in relation to the clocal temp of the host.**

## TABLE NO.11(C)

## CLOACAL TEMPERATURE OF THE HOST (76-80$^0$ F)

| Season | No. of Hosts | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Winter | 14 | 1 | 0.071 | 2 | 2.0 | 0.142 |
| Summer | 23 | 2 | 0.086 | 4 | 2.0 | 0.173 |
| Rainy | 12 | 1 | 0.083 | 2 | 2.0 | 0.166 |

## GRAPH NO. - 18




**Average annual variations in the Prevalence, Mean intensity and Relative density of cestode Infection in relation to the clocal temp of the host.**

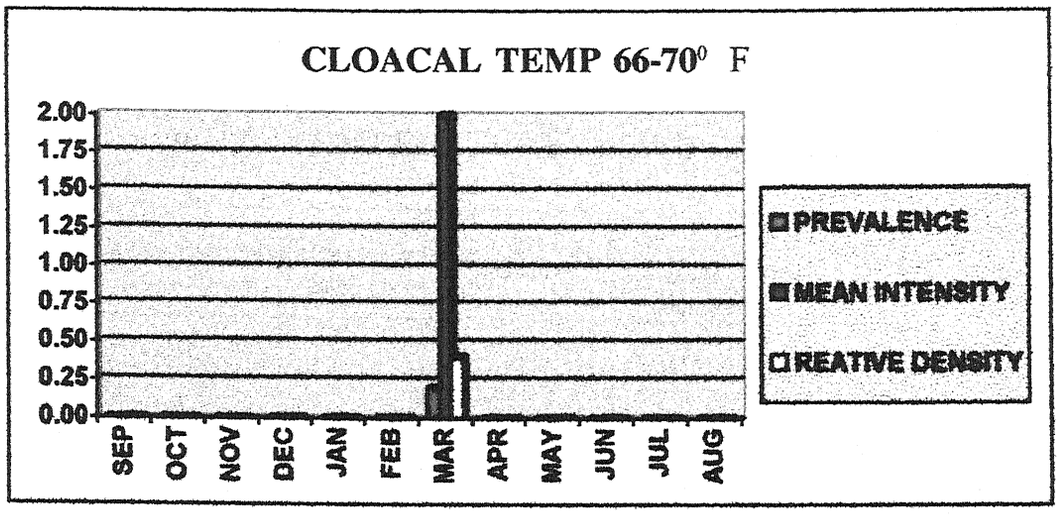
## TABLE NO.12(A,B,C)

## AVERAGE MONTHWISE VARIATIONS IN THE PREVALENCE, MEAN INTENSITY AND RELATIVE DENSITY OF CESTODE INFECTION IN RELATION TO THE CLOACAL TEMPRATURE OF THE HOST.

## TABLE NO.12(A)
## CLOACAL TEMPERATURE OF THE HOST (66-70$^0$ F)

| Month/Year | No. of Hosts | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Sep. (93+94) | 2 | - | - | - | - | - |
| Oct. (93+94) | 5 | - | - | - | - | - |
| Nov. (93+94) | 3 | - | - | - | - | - |
| Dec. (93+94) | 2 | - | - | - | - | - |
| Jan. (94+95) | 2 | - | - | - | - | - |
| Feb. (94+95) | 1 | - | - | - | - | - |
| March (94+95) | 5 | 1 | 0.2 | 2 | 2.0 | 0.4 |
| April (94+95) | 2 | - | - | - | - | - |
| May (94+95) | 2 | - | - | - | - | - |
| June (94+95) | 2 | - | - | - | - | - |
| July (94+95) | - | - | - | - | - | - |
| Aug. (94+95) | - | - | - | - | - | - |

## GRAPH NO. - 19



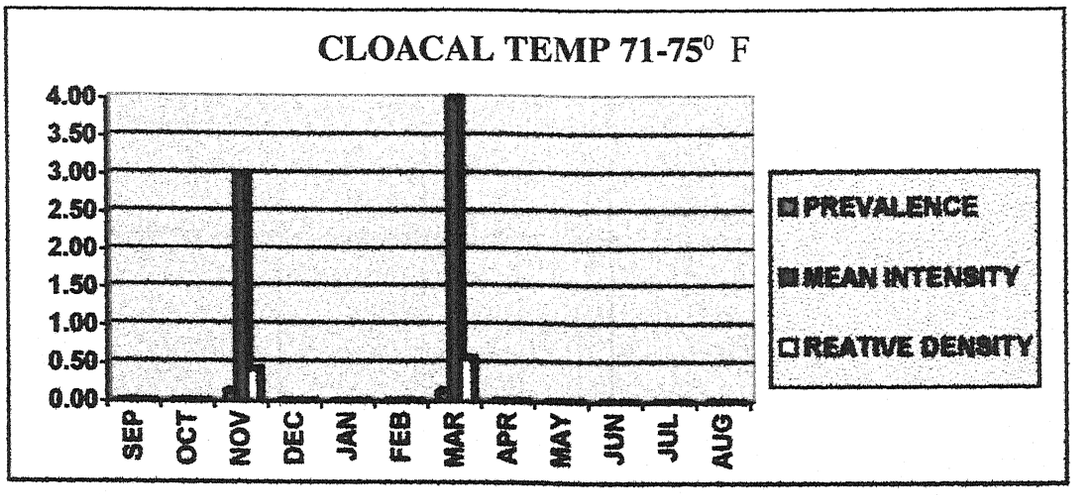

**Average annual variations in the Prevalence, Mean intensity and Relative density of cestode Infection in relation to the clocal temp of the host.**

## TABLE NO.12(B)

## CLOACAL TEMPERATURE OF THE HOST (71-75$^0$ F)

| Month/Year | No. of Hosts | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Sep. (93+94) | 2 | - | - | - | - | - |
| Oct. (93+94) | 5 | - | - | - | - | - |
| Nov. (93+94) | 7 | 1 | 0.142 | 3 | 3.0 | 0.42 |
| Dec. (93+94) | 3 | - | - | - | - | - |
| Jan. (94+95) | 1 | - | - | - | - | - |
| Feb. (94+95) | 2 | - | - | - | - | - |
| March (94+95) | 7 | 1 | 0.142 | 4 | 4.0 | 0.57 |
| April (94+95) | 2 | - | - | - | - | - |
| May (94+95) | 2 | - | - | - | - | - |
| June (94+95) | 2 | - | - | - | - | - |
| July (94+95) | 2 | - | - | - | - | - |
| Aug. (94+95) | - | - | - | - | - | - |

## GRAPH NO. - 20



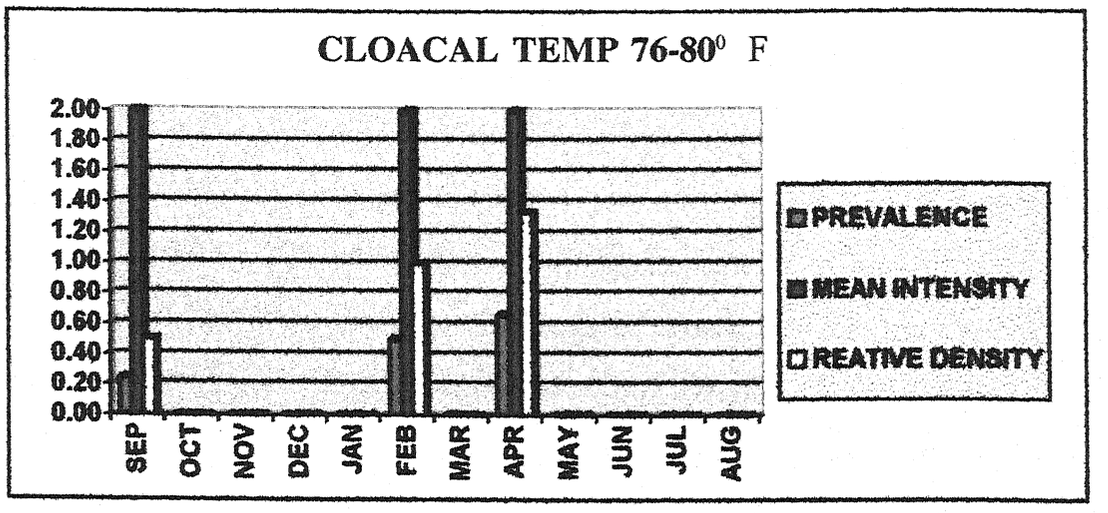

**Average annual variations in the Prevalence, Mean intensity and Relative density of cestode Infection in relation to the clocal temp of the host.**

## TABLE NO.12(C)

## CLOACAL TEMPERATURE OF THE HOST (76-80$^0$ F)

| Month/Year | No. of Hosts | | Prevalence | No. of cestode obtained | Mean intensity | Relative density |
|---|---|---|---|---|---|---|
| | Examined | Infected | | | | |
| Sep. (93+94) | 4 | 1 | 0.25 | 2 | 2.0 | 0.5 |
| Oct. (93+94) | 4 | - | - | - | - | - |
| Nov. (93+94) | 5 | - | - | - | - | - |
| Dec. (93+94) | 5 | - | - | - | - | - |
| Jan. (94+95) | 2 | - | - | - | - | - |
| Feb. (94+95) | 2 | 1 | 0.5 | 2 | 2.0 | 1.0 |
| March (94+95) | 7 | - | - | - | - | - |
| April (94+95) | 3 | 2 | 0.66 | 4 | 2.0 | 1.33 |
| May (94+95) | 5 | - | - | - | - | - |
| June (94+95) | 5 | - | - | - | - | - |
| July (94+95) | 3 | - | - | - | - | - |
| Aug. (94+95) | 4 | - | - | - | - | - |

## GRAPH NO. - 21




**Average monthwise variations in the Prevalence, Mean intensity and Relative density of cestode Infection in relation to the clocal temp. of the host.**

# DISCUSSION AND CONCLUSION

The fish *Channa punctatus* (Bloch.) generally infected with helninth parasites viz. cestodes, trematodes, nematodes and acanthocephala. Kinsella (1966) reported the dominance of nematodes over the trematodes and cestode infection in frogs. Srivastava A.N. (1987) reported the dominance of cestode infection over the nematode and trematode infetion doves. Srivastava B.K. (1989) reported the dominance of cestode infection in domestic fowls. Mathur N. (1992) reported the dominance of cestode infection in *Heteropneustus fossilis* (Bloch) Daring the course of present investigation in *Channa punctatus* (Bloch) however it was noted that acantnocephala constitute the dominant group of helminths, in their prevalence, mean intensity and relative density over the nematode , cestode and trematode infection but cestodes show second over nematodes and trematodes prevalence, mean intensity and relative density. In the present project the author has restricted herself to the ecological nature of infection, prevalence, mean intensity and relative denisty of cestode parasites only.

The prevalence of cestode in *Channa punctatus* (Bloch) has been found to be highest during summer in the present observations. This phenomenon may be related to the relative incidence of the intermediate hosts of these parasites. The food of *Channa punctatus* comprised of crustaceans, diptern larvae, algal mass, debris, insects larvae, adult insects and molluscs acts as intermediate host which is effeted by water temperature. Cestodes show an increase in their prevalence mean intensity and relative density in summer specially in spring season. This may be attributed to a resumption of feeding by the host at the end of winter with its oppertunities of aquiring new infection. A similer spring rise in the number of helminths has been reported by Markov and Rogoza (1955) . Lees (1962) also reported the highest incidence of parasitization by helminths occured in autumn in United Kingdom, where insects and other arthropods reappear after winter diapause with the maximum in spring. i.e. helminth abundance follows intermediate host abundance. Kinsella (1966) reported parasite prevalence during summer and rainy season and believs that the greater occurance of arthropods in this season is sole reason for their prevalence.

From the available reports thus a strong indication exists that there is a definite correlation between the occurencee of the parasites and their intermediate hosts during the year.

The prevalence of cestodes show a decline in winter. This again seems to be related to the minimum occurence of intermediate host during winter. The highest mean intensity of cestode infection was recorded in summer and winter. Apparently new infection is acquired in late winter and the hosts may not possess immunity, the mean intensity surviving hosts developes some immunity rises to a very great extent in early summers .Again as infection continuous and hence mean intensity of cestode infection decreases in late summer. This corresponds to the mean intensity of infection. Lees (1962) and Mazuromovich (1951) suggested lack of adequate food as the reason for their decline. A simlilar explanation can also be proposed for the relative density of cestodes which was highest in summer and lowest in rainy season.

## Cestode Infection And Host Body Weight -

The body weight of host is related to a number of factors ilke age, health, length an availability of food. The present observation indicates that the fish of intermediate body weight 56-110gm shows greater prevalence and relative density of cestode. He found intermediate sized fish with highest intensity of infection. Jha and Sinha (1990) also reported the higher prevalence and intensity of acanthocephala occurence in middle length groups and comparatively lower occurence in lower and higher length group of *Channa punctatus*. This finding is also reported by Amin (1986) for *Neoechinorhynchus cylidratns* (Van cleave, 1913). Who found a modest increase in worm burden by host size, which however became reversed in the largest male and females. He further mentioned that the decreased worm burden in largest fish may have been caused by age and related factors such as changes in feeding habits.

## Cestode Infection And Sex of The Host-

In the present observations female fishes show higher annual prevalence, and relative density of cestode infection than the male fishes. Kennedy (1969) while working on the

incidence of *Caryophylleus laticeps* in the dace. *Leuciscus leuciscus* has reported that degree of infection is higher in female than in males . The present observation support Kennedy's interpretation that females are possible less resistant to the helminth infection because of the greater stress placed on them due to the frequent changes in their hormonal balance. Thomas (1964) has attributed this fact to the differences in the physiological resistance of males and females. Mutafora (1976) established greater survival rate by *H. gallinae* in natural bulgarian female chicken infection than in males. Srivastav (1989) reported the higher prevalence, mean intensity and relative density in females while working on domestic fowl . Malhotra (1992) reported havier infestation in female *Wallago attu* than in male fishes, Saberwal , Malhotra and Capoor (1992) reported higher prevlence and intensity of proteocephalids, *Gangesia hanumanthai* in females than in male fishes.

## Cestode Infection And Cloacal Temperature of Host -

The present observation show higher mean intensity and relative density at 71 -75$^0$ F but higher prevalence at 76 - 80$^0$ F temperature. According to Chubb (1977) and Kearn (1986) temperature affects egg production, larval development, maturation and worm survival in many fish monogeneans, thus controlling seasonal population cycle. Esch (1983) reported that in many cestodes temperature is the single most important factor influencing seasonal cycles, either directly effecting recruitment and predator-prey interaction between final and intermediate hosts. Observation also supports Toeque and Tinsley (1991).

# PART-D

# HAEMATOLOGICAL OBSERVATIONS

The study of these blood values is divided into three categories

1. Haematological values in relation to length and width of *Channa punctatus*.

2. Seasonal variation in related haematological values of *Channa punctatus*.

3. Comparative variation in some haematological valuses of infected and uninfected *Channa punctatus*.

In first category (Table no.13) haemoglobin percentage increase acording to their body weight. Haemoglobin percentage is lower 10.0 ± 0.3 in group (A) 0-55 gm body weight and higer 13.50 ± 0.8 in group (D) 166-210 gm body weight.Packed cell volume is also lower 23.65 ± 2.5 in in group (A) 0-55 gm body weight and higher 46.62 ± 2.3 in group (D) 166-210 gm body weight. It also increase to their body weight.

Total erythrocyte count is lower 2.05 ± 0.1 in group (A) 0-55 gm body weight and higher 3.35 ± 0.3 in group (C) 111-165 gm body weight while total leucocyte count is lower 15875.0 ± 1237 in group (A) 0-55 gm body weight and higher 19756.0 ± 1917 in group (D) 166-210 gm body weight.

Mean corpuscular volume is lower 115.36 ± 10.6 in group (A) 0-55 gm body weight and higher 152.85 ± 12.5 in group (D) 166-210 gm body weight. It is also increase to their body weight.

Mean corpuscular haemoglobin is 48.75 ± 2.5 in group (A) 0-55 gm body weight, 37.79 ± 1.9 in group (B) 56-110 gm body weight. 37.52 ± 1.9 in group (C) 111-165 gm body weight and 44.26 ± 2.3 in group (D) 166-210 gm body weight while mean corpuscular haemoglobin concentration is 42.28 ± 3.9 in group (A) 0-55 gm body weight, 31.78 ± 4.5 in group (B) 56-110 body weight, 27.68 ± 2.1 in group (C) 111-165 gm body weight and 28.95 ± 2.9 in group (D) 166-210 gm body weight.

In second category ( Table No. -14 ) Haemoglobin percentage of male Channa fish is lower 10.0 ± 1.22 in winter and higher 12.95 ± 0.78 in summer while in female Channa fish haemoglobin percentage is lower 9.8 ± 0.31 in winter and higher 11.50 ± 1.50 in rainy season. Packed cell volume of male Channa fish is lower 32.10 ± 1.21 in winter and higher 42.80 ± 2.25 in summer while in female Channa fish packed cell volume is lower 29.70 ± 1.35 in winter and higher 42.12 ± 1.05 in rainy season.

Total erythrocyte count of male Channa fish is lower 1.80 ± 0.30 in winter and higher 2.85 ± 0.55 in rainy season while in female Channa fish total erythrocyte count is lower 1.75 ± 0.75 in winter and higher 2.98 ± 0.26 in rainy season.

Mean corpuscular volume of male Channa fish is lower 178.33 ± 16.63 in winter and higher 203.80 ± 19.0 in summer while in female Channa fish mean corpuscular volume is lower 169.71 ± 13.9 in winter and higher 154.68 ± 12.5 in summer.

Mean corpuscular haemoglobin of male fish is 55.55 ± 3.25 in winter, 61.66 ± 3.13 in summer and 38.42 ± 3.05 in rainy season while in female Channa fish 56.00 ± 3.16 in winter, 46.17 ± 2.28 in summer and 38.59 ± 2.57 in rainy season. In the same way mean corpuscular haemoglobin concentration of male fish is 31.15 ± 2.57 in winter, 30.25 ± 2.24 in summer and 30.64 ± 3.96 in rainy seasonwhile in female Channa fish 32.99 ± 2.90 in winter, 29.84 ± 1.75 in summer and 27.30 ± 2.87 in rainy season.

In third category ( Table No.-15 ) haemoglobin percentage, Packed cell volume, Erythrocyte sedimentation rate and total erythrocyte count of infected Channa is lesser than uninfected Channa while Total leucocyte count of infected Channa is higher then uninfected Channa.

In above obserbation haemoglobin percentage of infected Channa is 11.75 ± 0.3 and uninfected Channa 12.95 ± 0.5, packed cell volume of infected Channa is 40.96 ± 0.5 and uninfected Channa 42.56 ± 0.8, erythrocyte sadimentation rate of infected Channa is 1.12 ± 0.5 and uninfected Channa 0.98 ± 0.1 total erythrocyte count of infected Channa is 2.75 ± 0.5

and uninfected Channa 2.25 ± 0.7, total leucocyte count of infected Channa is 12752 ± 2237 and uninfected Channa 17875 ± 2237.

Infected *Channa punctatus* have mean corpuscular volume 182.04 ± 14.2, mean corpuscular haemoglobin 52.22 ± 2.5 and mean corpuscular haemoglobin concentration 30.42 ± 2.5 while uninfected *Channa punctatus* have mean corpuscular volume 154.76 ± 10.4, mean corpuscular haemoglobin 47.09 ± 1.9 and mean corpuscular haemoglobin concentration 28.68 ± 3.8.

# TABLE NO.-13

## HAEMATOLOGICAL VALUES IN RELATION TO LENGTH AND WEIGHT OF CHANNA PUNCTATUS

## (All Values are Mean ± S.E.)

| Group | Weight (gm) | Length (cm) | Hb% (gm) | PCV% (mm/hr) | ESR (-x10.6) | TEC (/cm) | TLC (cm3) | MCV (pg) | MCH | MCH% |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 0-55 | 10.2 ± 0.5 | 10.0 ± 0.3 | 23.65 ± 2.5 | 1.15 ± 0.5 | 2.05 ± 0.1 | 15875.0 ± 1237 | 115.36 ± 10.6 | 48.78 ± 2.5 | 42.28 ± 3.9 |
| B | 56-110 | 13.5 ± 1.1 | 11.15 ± 0.2 | 35.08 ± 7.5 | 1.09 ± 0.4 | 2.95 ± 0.1 | 19366.0 ± 2120 | 118.92 ± 15.4 | 37.79 ± 1.9 | 31.78 ± 4.5 |
| C | 111-165 | 17.6 ± 1.2 | 12.57 ± 0.8 | 45.40 ± 5.4 | 1.12 ± 0.3 | 3.35 ± 0.3 | 19150.0 ± 2392 | 135.52 ± 9.2 | 37.52 ± 2.2 | 27.68 ± 2.1 |
| D | 166 - 210 | 20.1 ± 2.0 | 13.50 ± 0.8 | 46.62 ± 2.3 | 1.10 ± 0.5 | 3.05 ± 0.1 | 19756.0 ± 1917 | 152.85 ± 12.5 | 44.26 ± 2.3 | 28.95 ± 2.9 |

## TABLE NO.- 14

## SEASONAL VARIATION IN RELATED HAEMATOLOGICAL VALUES OF CHANNA PUNCTATUS

### (All Values are Mean ± S.E.)

| SEASON | WINTER | SUMMER | RAINY |
|---|---|---|---|
| Total Erythrocyte Count (TEC) | | | |
| MALE | 1.08 ± 0.30 | 2.10 ± 0.23 | 2.85 ± 0.55 |
| FEMALE | 1.75 ± 0.75 | 2.35 ± 0.25 | 2.98 ± 0.26 |
| Haemoglobin (HB) | | | |
| MALE | 10.00 ± 1.22 | 12.95 ± 0.78 | 10.95 ± 1.65 |
| Female | 9.8 ± 0.31 | 10.85 ± 0.15 | 11.50 ± 1.50 |
| Packed Cell Volume (PCV) | | | |
| MALE | 32.10 ± 1.21 | 42.80 ± 2.25 | 35.73 ± 1.20 |
| FEMALE | 29.70 ± 1.35 | 36.35 ± 2.95 | 42.12 ± 1.05 |
| Mean Corpuscular Volume (MCV) | | | |
| MALE | 178.33 ± 16.6 | 203.80 ± 19.0 | 125.36 ± 11.6 |
| FEMALE | 169.71 ± 13.9 | 154.68 ± 12.5 | 141.34 ± 12.3 |
| Mean Corpuscular Gaemoglobin (MCH) | | | |
| MALE | 55.55 ± 3.25 | 61.66 ± 3.13 | 38.42 ± 3.05 |
| FEMALE | 56.00 ± 3.16 | 46.17 ± 2.28 | 38.59 ± 2.57 |
| Mean Corpuscular Gaemoglobin Concentration (MCHC) | | | |
| MALE | 31.15 ± 2.57 | 30.25 ± 2.24 | 30.64 ± 3.96 |
| FEMALE | 32.99 ± 2.90 | 29.84 ± 1.75 | 27.30 ± 2.87 |

# TABLE NO.- 15

## COMPARATIVE VARIATION IN SOME HAEMATOLOGICAL VALUES OF INFECTED AND UNINFECTED CHANNA PUNCTATUS

### (All Values are Mean ± S.E.)

| FISH | Hb (gm%) | PCV (mm/hr) | ESR (-x10.6/cm) | TEC (/cm) | TLC (cm3) | MCV (pg) | MCH | MCHC (%) |
|---|---|---|---|---|---|---|---|---|
| Uninfected | 12.95 ± 0.5 | 42.56 ± 0.8 | 0.98 ± 0.8 | 2.75 ± 0.5 | 17875 ± 2237 | 154.76 ± 10.4 | 47.09 ± 1.9 | 28.68 ± 3.8 |
| Infected | 11.75 ± 0.3 | 40.96 ± 0.5 | 1.12 ± 0.5 | 2.25 ± 0.7 | 12752 ± 1877 | 182.04 ± 14.2 | 52.22 ± 2.5 | 30.42 ± 2.5 |

# PART-E

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